1984

The cost-benefit analysis of selected cooperative and in-school instruction in vocational industrial education at secondary level in Taiwan, R O C

Tze-Li Charles Kang
Iowa State University

Kang, Tze-Li Charles

THE COST-BENEFIT ANALYSIS OF SELECTED COOPERATIVE AND IN-SCHOOL INSTRUCTION IN VOCATIONAL INDUSTRIAL EDUCATION AT SECONDARY LEVEL IN TAIWAN, R. O. C.

Iowa State University PH.D. 1984

The cost-benefit analysis of selected cooperative and in-school instruction in vocational industrial education at secondary level in Taiwan, R. O. C.

by

Tze-Li Charles Kang

A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY

Major: Industrial Education and Technology

Approved:

Signature was redacted for privacy.

In Charge of Major Work

Signature was redacted for privacy.

For the Major Department

Signature was redacted for privacy.

For the Graduate College

Iowa State University
Ames, Iowa

1984

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CHAPTER I. INTRODUCTION

Vocational education is a complex enterprise that cannot be simply defined or easily categorized. Some educators defined vocational education in its broadest sense as learning experiences provided to students in one or more skilled, semi-skilled or technical occupations. On the contrary, some educators defined vocational education, in the narrow sense, as an education provided to students for occupational competence (Calhoun and Finch, 1982; Maley, 1975; Powers, 1977; Roberts, 1976). Therefore, we can classify vocational education into two broad categories: general vocational education and occupational specified vocational education.

Vocational education can be categorized by the service field of curriculum content which is related such as agriculture, distributive occupation, business, home economics, trade and industry, health services, and personal services. In addition, vocational education can be classified by the instructional method. Generally, cooperative method and in-school method are two common approaches provided by secondary schools.

Cooperative vocational education is provided as a method of vocational education for persons who, through written cooperative agreement between the school and employers, receive instruction, including required academic courses and related vocational instruction by alternation of study in school with a job in any occupational field; but these two experiences must be planned and supervised by the school personnel and employers so that each contributes to the student's education and to his/

her employability. The alternation of study in school with time at the training station is most commonly accomplished on a half-day basis. Under this arrangement, a student spends half of each day in school and the other half is spent working at a job which is related to his/her career goal. There are, however, other instructional arrangements which accomplish the alternation on a daily, weekly, or term basis.

During the past few years, in Taiwan, the relationship between the national education system and the national economy has attracted considerable public attention. While much of this attention has been focused on the economic arguments for increasing public investment in education, there has been relatively little research on the actual effectiveness of the educational system.

There are three types of program evaluation approaches conducted in educational programs (Hu and Stromsdorfer, 1979). The first is concerned primarily with inputs. This type of evaluation is usually conducted by a visiting team of experts and considers such matters as administration, instructional programs, physical facilities and instructional staff. The second type of evaluation is concerned primarily with process. It is conducted by observers over a period of time to see what happens in the educational process such as teaching method, leadership, teacher quality and the interaction among administrators, teachers and students. The third type of evaluation deals with outputs or outcomes, such as cost-benefit or cost-effectiveness of the program, and the product of programs. Probably one of the most familiar approaches or techniques

currently being used to measure the benefits and cost of vocational education is cost benefit analysis (Simison, Shugoll et al., 1981; Warmbrod, 1968).

The Statement of the Problem

The problem of this study was to investigate and to compare the economic costs and benefits as well as the noneconomic benefits of the selected programs (machine shop, electricity, furniture making, and printing) in cooperative vocational industrial education instruction and in-school vocational industrial educational instruction at the secondary level in Taiwan, R.O.C.

The Statement of the Purpose

The purpose of this study was to conduct a cost-benefit analysis of the selected cooperative and in-school instructional methods of vocational industrial education at the secondary level in Taiwan, the Republic of China, to offer comprehensive information of program efficiency to the public, educators, and educational administrators for planning and for evaluating the existing programs.

The specific purposes of this study were listed as follows:

1. To synthesize, from existing cost-benefit and cost-effectiveness research literature, critical elements of cost-benefit systems to vocational education in Taiwan.
2. To investigate the economic costs and benefits as well as

noneconomic benefits for graduates of selected programs in 1977 of cooperative and in-school instructional methods of vocational industrial schools in Taiwan.

3. To compare the economic and noneconomic benefits and the costs of selected programs between cooperative and in-school methods of vocational industrial schools in Taiwan.
4. To provide administrators and educators in vocational education and the public with data that will be helpful in evaluating the program product of existing vocational industrial education in Taiwan.

Background Information and Significance

Taiwan is a province of the Republic of China. It is an island of 35,989 square kilometers (13,895 square miles), slightly smaller than either Switzerland or the Netherlands, or the combined area of Connecticut, Massachusetts, and Rhode Island, with a population of 18 million in 1981 (Ministry of Education, 1982). Although Taiwan has always been plagued by meager natural resources and highly dense population, the last three decades has witnessed a dramatic improvement in the Taiwan economy. Since the latter part of the 1970s, the economic success of Taiwan has become progressively better known in the world. Numerous statistical indicators of success can be readily cited. For instance, at 1976 prices, Taiwan's per capita GNP rose from NT$10,521 in 1952 to NT$19,523 in 1956 (an increase of 85.9%), and NT$58,923 in 1981 (an increase of

460%). Labor productivity, measured in terms of GDP (gross domestic product) per person employed, rose from NT$68,467 in 1965 to NT$145,850 in 1979 (an increase of 113%) both at 1976 prices. Total foreign trade turnover (export plus imports) increased from the paltry figure of US$303 million (current dollars) in 1952 to US$1,006 million in 1965 (an increase of 232%) and then to US$43,811 million (an increase of 14,459%) in 1981. Taiwan's foreign trade was 1.0% of the IMF's world trade in 1979 and 14.6% of the foreign trade of Japan, although in 1978 Taiwan had only 0.4% of the population of the world's 125 nations listed in the World Bank's World Development Report (1980). These figures and others are more than enough to secure a place for Taiwan in the world economy.

Education is one of the main factors that has contributed significantly to the last three decades' economic achievement in Taiwan. This point of view is widely shared by educators and economists. Theodore Chen is one of them. In "The Taiwan Experiments 1950-1980," he states that the experience of the Republic of China in Taiwan has been described as a remarkable success story. It is no overstatement to say that educational growth is a major aspect of this experience and story. Education not only reflects the economic development and the social and political progress of the last three decades, but it must also be recognized as a potent force in laying a firm foundation for continuing Taiwan's growth and advancement from a developing country to the threshold of an industrialized and modernized society (Chen, 1981). Kuo (1983) also asserts that education in Taiwan has been effectively geared to economic development. The political situation has remained stable; and coupled

with this political stability, education under a centralized system has contributed significantly to Taiwan's widely reported economic growth.

The vast expansion of education is evident in numerous excerpts. The number of schools jumped from 1,504 in 1950 to 5,183 in 1982, the student population grew from 1,055,000 to 4,622,186. Six-year compulsory education is well-enforced; 99.72% of school-age children are reported to be attending schools. Since 1968, the junior high school has been added to the elementary school to form a period of nine years of free education; 96.78% of elementary school graduates were reported to be attending nine years of free education in 1982. Entrance examinations are required for admission to the senior high school, but the government of the Republic of China is conducting an experimental twelve-year vocational education program for junior high school graduates to advance without entrance examinations to different types of vocational schools that parallel the senior high school. It will be implemented nation-wide by the school year of 1990. If so, free education will have been extended to twelve years, from age 6 to 18. In view of the popular demand for education and the economic prosperity of the island, it is not impossible to realize this hope in the foreseeable future.

Vocational education is one of the most outstanding and important sectors of educational growth in the last three decades. In order to meet the growing need for technical manpower in business and industry, efforts have been made to open new vocational high schools as well as to expand existing ones. Since 1971, students in vocational schools have outnumbered those in academic schools. While enrollments in vocational

schools have grown steadily in the past quarter century, the number of students in academic schools began to decline in 1973. The enrollment of vocational high school students and general high school students reached 7 to 3 ratio in 1980 (Ministry of Education, 1982).

In order to cope with the manpower needs of industrialization in Taiwan, vocational industrial education enrollment increased rapidly during the past two decades. According to government statistics, in 1946, the total vocational education enrollment was 23,316, with 6,898 students enrolled in vocational industrial programs (29.58% of vocational education enrollment). In 1967, the total vocational education enrollment increased to 119,346, and 22,010 students enrolled in vocational industrial programs (18.44%), and in 1982, there were 266,681 students enrolled in vocational education, among them 138,664 enrolled in vocational industrial programs (52% of vocational education enrollment). Today, vocational industrial education in Taiwan plays a very important role in the total education system.

Cooperative vocational education is one of the delivery methods used in vocational education to prepare students for a job. Vocational education in Taiwan started to experiment the feasibility of cooperative vocational education in 1969. One pilot program was established at Sa-loo Vocational industrial high school in cooperation with Sun-Kaun Machinery Manufacturing Company and Ton-Jan Machinery Manufacturing Company. Eighty students enrolled in the first program.

Table 1. The enrollment of vocational industrial schools in the total vocational education in Taiwan (Ministry of Education, 1982)

Classification	1946		1967		1981	
	No. of students	%	No. of students	%	No. of students	%
Vocational education	23,316	100	119,346	100	266,681	100
Vocational industrial education	6,898	29.58	22,010	18.44	138,664	52

Owing to the success of the pilot program and the demands of technical manpower in the process of Taiwan industrialization, cooperative vocational education grew rapidly during the past decade. It grew from one school, two cooperative industries, one occupational area, and an 80 students enrollment in 1969 to 48 schools, 246 cooperative industries, 18 occupational areas and 13,571 students enrolled in 1980. As shown in Table 2, cooperative vocational education instruction in Taiwan will continue its rapid growth to cope with Taiwan's manpower needs of industrialization.

It is often argued by some educators that vocational education costs are too high (Corazzini, 1966; Taussig, 1968), while some others see these same costs of vocational education as adequate and an economically worthwhile investment for individuals and for society (Kaufman, Hu, Lee, and Stromsdorfer, 1967). So it is important for public, educators, and educational policymakers to make rational decisions concerning investment

Table 2. The growth of cooperative vocational education in Taiwan (Ministry of Education, 1982)

Year	No. of schools	No. of coop. ind.	No. of occ. areas	No. of students
1969	1	2	1	80
1980	48	246	18	13,571

in various vocational education programs based on the comprehensive information about the costs and benefits of these programs.

Hu and Stromsdorfer (1979) analyzed many of the problems in cost and benefit measurement of vocational education. Davie (1967) explains three criteria for making benefit-cost decisions in the context of vocational education. Kaufman and Lewis (1968) discuss the logic and meaning, misconceptions, problems and limitations of cost-benefit methodology in vocational education. Stromsdorfer (1972) explains, among other issues, the computation of opportunity costs, the problems in selecting a discount rate and the danger of double-counting the benefits of vocational education. Cardus, Fuhrer, and Thrall (1980) did a research study in the area of rehabilitation rather than vocational education. However, they suggested some means of measuring nonpecuniary benefits which had traditionally been the major measurement difficulty in cost-benefit analysis of vocational education. Kim (1977) and Kim et al. (1976) have designed models that combine techniques of cost-benefit analysis with those of cost-effectiveness analysis. These models can generate three kinds of

program measures: program effectiveness, cost-efficiency, and a cost-effectiveness and performance ratio. Darcy (1980) contributes several outcomes to specify measurable benefits of the vocational education. He defined 15 vocational education outcomes and discussed their use in evaluation research.

Vocational education is a major component of secondary and post-secondary education systems in Taiwan. It is considered one of the important educational programs for aiding students to make the transition from school to work. It is also considered, however, as being more expensive than other secondary educational programs. The constant concern over and debate on the merits of vocational education by educators, education policymakers, and the public have been drawing many researchers to examine the costs of vocational education, the efficiency of vocational education, and the effectiveness and benefits of vocational education.

Hypotheses of the Study

Research Hypothesis 1:

There is no significant difference between the costs (private and social cost) of cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

H_0: $\mu_1 = \mu_2$ $\qquad$ H_A: $\mu_1 \neq \mu_2$

Research Hypothesis 2:

There is no significant difference between the earning of graduates from cooperative and in-school instructional methods of selected programs

in vocational industrial high schools during the first five years of work.

H_0: $\mu_1 = \mu_2$ H_A: $\mu_1 \neq \mu_2$

Research Hypothesis 3:

There is no significant difference between the net present value of benefits (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

H_0: $\mu_1 = \mu_2$ H_A: $\mu_1 \neq \mu_2$

Research Hypothesis 4:

There is no significant difference between the rate-of-return (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

H_0: $\mu_1 = \mu_2$ H_A: $\mu_1 \neq \mu_2$

Research Hypothesis 5:

There is no significant difference between the benefit-cost ratio (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

H_0: $\mu_1 = \mu_2$ H_A: $\mu_1 \neq \mu_2$

Research Hypothesis 6:

There is no significant difference between the payback period (private and social) of graduates from cooperative and in-school

instructional methods of selected programs in vocational industrial high schools.

H_0: $\mu_1 = \mu_2$ H_A: $\mu_1 \neq \mu_2$

Research Hypothesis 7:

There is no significant difference between the noneconomic benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

H_0: $\mu_1 = \mu_2$ H_A: $\mu_1 \neq \mu_2$

Research Hypothesis 8:

It is hypothesized that (1) the economic benefits, and (2) the noneconomic benefits of graduates from selected programs in vocational education cannot be predicted by these factors: (1) type of program, (2) student ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's education level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

H_0: $b_i = 0$ H_A: $b_i \neq 0$

Research Hypothesis 9:

There is no significant linear relationship between benefits (economic and noneconomic) of graduates from selected programs in vocational education and these factors: (1) type of program, (2) student's ability, (3) school status, (4) occupation for which trained, (5)

father's occupation, (6) father's education level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

H_0: $R_C = 0$ H_A: $R_C \neq 0$

Assumptions of the Study

This study was conducted under the following assumptions:

1. The procedures for selecting the research subjects were valid and adequate for making inferences for the general population of graduates in similar schools.
2. The size of the sample was sufficient to be sensitive to differences which may exist among independent variables.
3. The survey questionnaire was a valid measure for collecting information on costs and benefits of vocational graduates.
4. Respondents interpreted the questionnaire items correctly.
5. Respondents responded to the questionnaire honestly.

Limitations of the Study

1. The study was limited to the graduates of 1977 who were trained in machine shop, electricity, furniture making, or printing in the cooperative or in-school instructional methods of vocational-industrial high schools in Taiwan, the Republic of China. Rapid social change may impact on the educational growth of the graduates that would invariably threaten the generalizability of the research results.

2. Due to the longitudinal cohort survey which was employed in this study, respondents might not remember accurately information related

to a previous time, also poses another threat to the validity of the study.

Definition of Terms

Added costs: The added costs of a vocational program are calculated as being the difference in cost between the average cost (or marginal cost) of a vocational program and the cost of any other alternative program.

Average cost: The average cost of vocational education programs is the cost of producing one unit of output, in this case, one student. In other words, it equals the total cost divided by the number of students.

Capital costs: Capital costs are defined as being any investment in fixed assets. These costs include building and land.

Cost benefit analysis: Cost benefit analysis is a comparison of the costs and the resulting monetary benefits of one or more educational programs. It attempts to generate four criteria: (1) the net expected present value, (2) the cost-benefit ratio, (3) the expected internal rate of return, and (4) the expected payback period. Noneconomic benefits are often considered in cost benefit analysis, however, they are not used in calculating the four criteria.

Cost effectiveness analysis: Cost effectiveness analysis is an analytical tool for assessing outputs of operating or alternative programs in achieving specified program objectives, as related to costs.

Direct costs: Direct costs entailing payments will not relate exclusively to educational items, such as fees for courses or purchases of

books and study materials, but will also cover ancillary items such as additional transport costs or living expenses.

Indirect costs: Indirect costs are usually thought of as the loss of money earnings which will occur in cases where the student would otherwise have been employed, or otherwise economically active. This loss of earning arises because, in addition to materials such as books, it is also necessary for the student to devote time to the acquisition of education; and time, being a scarce resource, has various alternative uses on which a value can be placed.

Marginal costs: Marginal costs are defined as the addition to total costs incurred by the production of an extra unit of output. In educational terms, this usually means asking what is the cost of educating one extra child in a class or a school or a sector of education.

Operational costs: These costs are the cost of operating the school in a given year. Operational costs are subdivided into two groups, instructional costs and support costs. Instructional costs include costs for instructor, instructional resources and student services, while support costs include research, general administration, costs of plant operation and maintenance, fixed charge, and other school services.

Opportunity costs: All costs are really opportunity costs, as the cost of any activity is to forego the opportunity to undertake another activity. In this research, the opportunity cost of a vocational education is the foregone opportunity to work for an income and the costs of using plant for alternative purposes.

Private costs: The costs of the individual, the private costs of education, include expenditure on fees, books, travel etc., and the opportunity cost of students' time as measured by earnings foregone; any scholarships or grants which cover all or some of a student's fees or maintenance costs must of course be deducted, to show exactly what costs are actually incurred by the student himself, or his family.

Rate of return: Rate of return is the rate of interest at which the present discounted value of the costs of education are exacted equal to the present value of expected benefits. In other words, it is a measure of the yield of profitability of the investment. The higher the rate of return the more profitable the investment.

Social costs: The cost to society, the social costs of education, include all expenditures on teachers' salaries, other current expenditures, the value of building and equipment, and the opportunity cost of students' time, once again measured by income foregone, as a proxy measure of the production forgone by society when students continue their education rather than join the labor market.

Total costs: The total cost of a vocational program is equal to the sum of the capital costs, the operational costs, and the opportunity costs of the program.

Economic benefits: The economic benefits of vocational education are defined as the change in economic welfare of society (social benefits) and the individuals (private benefits) caused by vocational education.

Noneconomic benefits: The noneconomic benefits of vocational education are defined as the change of welfare other than economic welfare caused by vocational education. The noneconomic benefits are divided into two types: First are those benefits which related specifically to the job environment, such as greater job opportunities, greater job satisfaction, positive work attitude, educational effectiveness, etc. The second measure of noneconomic benefits deals with the socialization effects of education, such as better citizenship, greater sense of well-being.

Vocational education: Vocational education is defined to include only senior high school programs. A vocational program is intensive occupational preparation for a specific occupational objective or a cluster of occupations.

Cooperative method: Cooperative method is defined as an instructional approach for providing vocational education for persons who, through a cooperative arrangement between the school and employers, receive instruction including required academic courses and related vocational instruction by alternation of study in school with a job in any occupational field, but these two experiences must be planned and supervised by the school and employers so that each contributes to the student's education and to his employability.

In-school method: In-school method is the program which provides vocational training totally within the school environment.

Procedure of the Study

1. To synthesize, from existing cost-benefit and cost-effectiveness research literature, the critical elements of cost-benefit systems to vocational education in Taiwan.
2. To determine the population of the study. In order to make costs and benefits comparison between cooperative and in-school instructional methods, the graduates who were trained in machine shop, electricity, furniture making, or printing by one of these two methods in 1977 were identified as the population of this study.
3. To select the sample from the population. A multistage cluster sampling technique was employed to select the sample from the population. First, the schools that had graduates of both instructional methods in 1977 served as the target schools. A random selection was made from the target schools. Once the schools had been selected, the researcher further reduced the sample size by randomly cluster selecting the sample from these selected schools.
4. To develop a cost-benefit survey form which contained basic data, the costs list, the economic benefits, and the noneconomic benefits of the research participants.
5. To verify the content validity, plausibility of items, and the appropriateness of questionnaire item construction; assistance was sought from the experts at Iowa State University.
6. To revise the questionnaire based on the recommendations of the experts.
7. To translate the revised questionnaire into Chinese.

8. Ten experts from National Taiwan Normal University served as the judge to verify the content validity of the questionnaire, and to rate the weighted domain weight of the eleven domains of noneconomic benefits.
9. Sixty experts including: 20 vocational teacher educators, 20 vocational industrial school teachers, and 20 supervisors from industries were selected to judge the scale value of the attitude items of the questionnaire.
10. To conduct a pilot test in Taipei, Taiwan. Twenty-five graduates who graduated from the cooperative instructional method and twenty-five graduates from the in-school instruction comprised the pilot sample. The responses and comments on the pilot test were reviewed, and the reliability was computed on selected items.
11. To revise and to print the questionnaire.
12. To collect the data: (1) The survey questionnaire was mailed to each of the research participants. (2) The follow-up letters were sent to nonrespondents. (3) A thank you letter was mailed to all research respondents. (4) Social costs and opportunity cost of student, unemployment rate up to 1977, and other statistics were collected from government statistics.
13. To calculate the costs and benefits of both programs. The net present discounted value, rate of return, benefits and costs ratio, payback period were calculated to compare the cost-benefits of both samples. The t-test technique was employed to test the difference.

14. A stepwise multiple regression technique was employed to investigate the relationship among economic benefits, noneconomic benefits and the family background, employment location, on-the-job training, age, ability, and other independent variables of this study.
15. The canonical correlation technique was employed to test the relationship between benefits (economic and noneconomic) and the independent variables of this study.
16. The probability level of this study was selected at .05 level.
17. To draw conclusions based on the results of the data analysis.
18. To report the research result.

CHAPTER II. REVIEW OF THE LITERATURE

This chapter synthesizes and presents (1) the literature on the economics of education, (2) literature on cost-benefit analysis, (3) literature on cost-benefit analysis in vocational education, (4) review of major findings of cost-benefit analysis, (5) review of cost-benefit studies in Taiwan, and (6) summary.

Literature on the Economics of Education

Education is an enterprise that is not very well-defined. One of the better ways to define it is both as a process and a product, the process being that of acquiring knowledge, the product being the knowledge that has been acquired and the effect this knowledge has on the individual and society. Parallel to this concept of education being a process which puts out a product, is the concept of costs and benefits--costs relating to the education process and the benefits relating to the educational product (Marson, 1978).

The concepts of cost and benefit in education require that the educators take a critical look at their system and remove inefficiencies in their resource allocation and utilization. This approach requires a balanced emphasis on inputs and outputs of education by establishing relationships between the two so that alternatives of producing outputs with different mixes of inputs can be analyzed on a scale of cost-benefit and of cost-effectiveness.

The research of economists has consistently shown a favorable relationship between an individual's educational attainment and his prospects

for employment and subsequent income (Levin et al., 1971). In other words, as the number of years of schooling completed increases, so does a persons' annual income and total lifetime income. Also, it is generally agreed that education yields rates of return on investment both from the point of view of society as a whole and for the individual that are at least as great as the financial returns to investment in corporate enterprise. Education produces a labor force that is more skilled, more adaptable to change and likely to develop imaginative ideas, techniques and products that are critical to expansion, growth and adaptation to change. So education, by contributing to worker productivity, in turn, has positive effects on economic growth (Weisbrod, 1966). Economists estimate that about one-fifth of the growth in total national income in the United States during the past three or four decades can be attributed to the increased education of the labor force (Denison, 1962).

In general, there are four approaches that can be distinguished to assess the economic contribution of education (Bowen, 1968). They are:

1. The Simple Correlation Approach: This approach consists of correlating some overall index of educational activity with some index of the level of economic activity.

2. The Residual Approach: This approach consists of taking the total increase in economic output of a country over a given period of time, identifying as much of the total increase as possible with measurable inputs (capital and labor being the two measurable inputs usually chosen) and then saying that the residual is attributable to the

unspecified inputs. Education and advances in knowledge are usually regarded as the most important of the unspecified inputs.

3. The Forecasting-Manpower-Needs Approach: The objective of all "forecasts" of manpower needs is, of course, to provide the persons responsible for educational planning with information as to the likely future needs of the economy for persons with various kinds of training.

4. The Direct Returns-to-Education Approach: This approach consists of studying the economic consequences of education by contrasting the lifetime earnings which can then be expressed as an annual percentage rate of return on the costs involved in obtaining the education.

"The Direct-Return-to-Education Approach" is also called "Cost Benefit Analysis" (Blaug, 1968). This approach has many attractions over others, not the least of which is that educational benefits are related to educational costs in a way that holds out the hope of providing useful information concerning the adequacy of the overall level of investment in education and the extent to which economic benefits accrue directly to private individuals (Bowen, 1968). Cost-Benefit Analysis is equally suitable to different types of secondary schools, different channels of higher education, and even to on-the-job training as a substitute for formal education (Blaug, 1968).

Two types of calculation of returns to education have been attempted (Vaizey, 1974). One method is to calculate the return to the individual's investment in education by comparing the costs incurred by the individual, and the returns received by him as a result of this education. The result rate is termed the private rate of return. The other

method is to derive the social rate of return by treating expenditure on education as a social investment and to calculate the costs incurred by and the returns accruing to society.

Stromsdorfer (1972) has stated that cost-benefit and cost-effectiveness analyses can provide information on the following subjects to educators and policymakers: (1) accountability, cost analysis alone can be helpful in accounting for the use of public funds; (2) efficiency, cost analysis can shed light on the question of the optimal scale (size) or the least condition of a vocational education program; (3) resource reallocation, cost-effectiveness and cost-benefit analyses can help to assess the alternative courses of action decision-making in maximizing the well-being of society; and (4) evaluation, cost-effectiveness and cost-benefit analyses can be used as evaluation tools to monitor the efficiency and effectiveness of the education program; thus, educational administrators can modify or improve the process of education.

The main deficiency of cost-benefit analysis is that it cannot quantify the indirect benefits of education. In fact, education not only has direct benefits which can be quantified by economical techniques but also indirect benefits. Vaizey (1974), in his "Economics of Education," affirms that "expenditure on education pays," by virtue of the fact that "the indirect benefits of education are so great that its direct benefits are not necessarily the most important aspect." This point of view is wisely shared, even by economists who, in analyzing the returns to educational investment, have despaired of ever quantifying the indirect benefits of education (Blaug, 1968).

Blaug (1968) reviewed the literature and listed a specification of the variety of indirect benefits in education. They are: (1) the current spillover income gains to persons other than those who have received extra education; (2) the spillover income gains to subsequent generations from a better educated present generation; (3) the supply of a convenient mechanism for discovering and cultivating potential talents; (4) the means of assuring occupational flexibility of labor force and, thus, to furnish the skilled manpower requirements of a growing economy; (5) the provision of an environment that stimulates research in science and technology; (6) the tendency to encourage lawful behavior and to promote the voluntary responsibility for welfare activities, both of which reduce the demand on social services; (7) the tendency to foster political stability by developing an informed electorate and competent political leadership; (8) the supply of a certain measure of "social control" by the transmission of a common cultural heritage; and (9) the enhancement of the enjoyment of leisure by widening the intellectual horizons of both the educated and the uneducated.

Literature on the Cost-Benefit Analysis

Economic cost-benefit analysis

The first step in conducting an economic cost-benefit analysis is to determine what are the costs and what are the benefits of an educational program. In determining the cost aspect of a cost-benefit study, the starting point should be the total expenditures of the educational institution being evaluated. Once a total cost figure is derived, it

should be distributed or allocated to each individual cost center in the institution. Two main cost centers are the direct costs and the indirect costs. These two broad divisions are usually further divided into other cost centers to which costs can be allocated. These cost centers and the costs allocated to them are determined by the accounting records used by the educational institution. Therefore, the most important data gathering technique is a record analysis of all accounting records available in the educational institution that is being evaluated. This technique was used in this study.

Another important method of obtaining information is the mailed survey form. This method was also used in this study. In lieu of the mailed survey form, other techniques such as personal interviews or telephone surveys may be used.

Analysis techniques

There are four basic techniques used by current researchers for comparing economic costs and benefits of vocational education programs. These four techniques are: (1) net present value (NPV) method, (2) benefit-cost ratio (BCR) method, (3) rate-of-return (RR) method, and (4) payback period method. These methods are discussed in the following section.

Net present value (NPV) method The net present value method is one of the most commonly used techniques to relate costs and benefits. It is established by using a discount rate for all costs and benefits in order to reduce them to their present value. Once the present value has

been established, costs are subtracted from benefits with the remainder being equal to the net present value of the benefits of an educational program. The formula for calculating the net present value of benefits is as follows:

$$NPV = \sum_{t=0}^{N} \frac{B_t - C_t}{(1 + i)^t}$$

where:

B = total benefits

C = total costs

N = the total number of time periods

i = the social rate of discount

$B_t - C_t$ = the net benefits occurring in time period t.

The net present value method subtracts costs from benefits for each time period and then adjusts the net figure to a present value. As can be seen from the equation, the adjustment factor, (1 + i), grows at an exponential rate. Therefore, the size of in significantly affects the magnitude of the calculated net value.

Simison and others (1981) after a review of the literature of cost-benefit analysis criticized the net present value method stating that it provided an indication of the value of an investment but it gave no indication of the efficiency of that investment. The primary limitation of this evaluation technique is that it may provide significantly different valuations of an investment depending on the rate of discount that is used.

Benefit-cost ratio method The benefit-cost ratio (BCR) method is theoretically similar to the net present value method. Both methods discount the flow of costs and benefits to their present values. It is calculated by dividing the present value of benefits by present value of costs. The resulting value is an indicator of the efficiency of an investment. In all cases, this ratio has to be larger than "one" for an educational program to be beneficial. This procedure is represented by the equation:

$$BCR = \frac{\sum_{t=0}^{N} \frac{B_t}{(1+i)^t}}{\sum_{t=0}^{N} \frac{C_t}{(1+i)^t}}$$

where:

N = the total number of time periods

B_t = the benefits occurring in time period t

C_t = the cost incurred in time period t

i = the social rate of discount.

Unlike the net present value, the benefit-cost ratio method does provide an indication of the efficiency of an investment but does not indicate the net value expected to result from an investment. Like the net present value method, this evaluation technique may produce significantly different results depending on the rate of discount used. In addition, the calculated value depends upon the treatment of negative benefits (Simison et al., 1981).

Rate-of-return (RR) method The values generated by both the net present value and the benefit-cost-ratio methods depend upon the selection of the rate-of-time preference. This may be considered a deficiency because the magnitude of the discount rate significantly affects the valuation of an investment option and, yet, considerable controversy exists over the appropriate value for the discount rate (Simison et al., 1981). The rate-of-return (RR) method establishes the rate of interest that will make the present value of the benefits equal to the present value of the costs. It is calculated by determining what percent the costs have to be multiplied by in order to equal the benefits. The formula for calculating rate-of-return is:

$$RR = r \text{ such that } \sum_{t=0}^{N} \frac{B_t - C_t}{(1+r)^t} = 0$$

where:

N = the total number of time periods

$B_t - C_t$ = net benefits occurring in time period t

r = the rate of return.

Investment options can be ranked by the magnitude of "r" with an investment yielding a large "r" preferred to an investment yielding a smaller "r."

The rate-of-return method improves upon other evaluation criteria because its valuation is independent of the rate of time preference utilized. However, a trade-off with this evaluation technique is that it is unable to create specific rankings of investment options for different

individuals with particular rates of time preference (Simison et al., 1981).

Payback period method The payback period method is simply the length of time required to recoup the costs of an educational program. An individual will recoup the cost of the program through various means--the most important being increased tax revenue. The formula for calculating payback rate of return is:

$$\sum_{t=0}^{N} B_t - \sum_{t=0}^{N} C_t = 0$$

where:

N = the total number of time periods

B_t = the benefits occurring in the time period t

C_t = the costs incurred in time period t.

The payback period method is appealing because it is conceptually straightforward and analyzes the length of time an investment option takes to recover its costs. A shorter payback period is considered superior to a longer payback period. This evaluation method has two primary deficiencies. First, it fails to account for differences in total benefits which occur after the time period when costs have been recovered. Second, it ranks two investments that pay off their costs in the same time period equally, even if a considerably higher percentage of costs are returned significantly earlier in one investment (Simison et al., 1981).

Noneconomic cost-benefit analysis

Although noneconomic costs and benefits cannot be included in the four previously mentioned formulas for comparing costs to benefits, they can be included in a cost-benefit analysis. Webb (1974) summarized three basic ways to include noneconomic factors in an analysis. They are:

(1) Treat noneconomic factors as zero: Assume that no matter what the noneconomic factors are, they would not be greater in size and opposite in direction than the economic factors. In other words, noneconomic factors exist, not only in similar proportions as economic factors. In this case, it would not be necessary to identify and measure the noneconomic factors.

(2) Evaluate noneconomic factors and discount them: This can be done by measuring the noneconomic factors, then discounting them by predetermined discount rates in order to account for their value in relation to economic factors.

(3) Treat noneconomic factors as a separate entity: To do this, it is necessary to measure or evaluate noneconomic factors. However, the factors would be listed as a separate entity and would not be included in or compared with the economic factors.

In the past, most of the research treated noneconomic factors in the third way. In order to do this, it became necessary to develop a method for assessing value to the noneconomic factors above and beyond the four formulas for comapring the economic cost and benefit factors. The method consists of a set of norms. These norms are for such variables as job satisfaction, family background, mobility, membership in social

organizations, promotions on the job, etc., and they are establishing by averaging the returns gathered from surveys and tests used in the research.

Literature on Cost-Benefit Analysis in Vocational Education

Numerous researchers have applied the concepts of cost-benefit analysis to vocational education. A number of very useful articles in the literature was reviewed (Adams, 1972; Hu, 1980; Mertens et al., 1980; Stromsdorfer, 1972; Warmbrod, 1968). Hu's paper investigated some of the major measurement problems in cost-benefit analysis of vocational education and summarized the literature. Mertens et al. (1980) surveyed existing cost-benefit literature in the process of analyzing whether research findings are consistent concerning the impact of vocational education on certain output variables. A separate review was performed for secondary and postsecondary vocational education. Adams presented an excellent overview of research on adult vocational education prior to 1972.

Costs in vocational education

Vocational education costs are defined as the value of resources used for vocational education programs. These involve the costs of both providing and receiving the training. In general, costs may be split into their direct and indirect components. For the individual, direct costs entailing payments will cover not only educational items, such as fees for courses or purchases of books and study materials, but will also

cover ancillary items such as additional transport costs or living expenses. Indirect costs are usually thought of as the loss of money earnings which will occur in cases where the student would otherwise have been employed, or otherwise economically active. This loss of earning arises because, in addition to materials such as books, it is also necessary for the student to devote time to the acquisition of education, and time being a scarce resource, has various alternative uses on which a value can be placed (O'Donoghue, 1971).

Costs can also be classified by another method as social, public, and private. Social costs are incurred by the entire society and include both public and private costs. Public costs include the costs expended by governmental units (federal, state, and local), while private costs include the costs incurred by individual program participants (incidental costs to participants and earnings foregone while participating in the program) and donations from private organizations.

In addition to these classifications, there is a special category of program costs. Measured from the viewpoint of the program, these are the costs of operating a program and may include both public costs (governmental expenditures) and private costs (industry donations of time and equipment). Program costs can be used to examine the efficiency of the operation of a program. Within an educational program, costs can be divided into operating costs and capital costs. Operating costs include personnel costs, transportation costs, maintenance costs, and other costs relating to the current operation of the program. Capital costs include building costs and equipment costs.

The cost of vocational education may be measured using either average cost or marginal cost methods. Most of the research measures the costs of vocational education by including the average costs. Among the analyses employing marginal cost methods are Cohn, Hu, and Kaufman (1972), Osbur and Goishi (1974), and Swanson (1976).

The issue of joint costs is considered in a limited number of studies. Aldrich (1972) proposes three alternative criteria for calculating joint costs: the number of student credit hours, the number of full-time equivalent faculty, and classroom square footage. Hu, Lee, Stromsdorfer, and Kaufman (1967) ignore joint cost measurement because they believe that one student utilizing a facility does not deny similar usage by other students. Therefore, the joint costs are equal to the marginal costs of facility usage which are zero.

Benefits in vocational education

The benefits of a vocational education program include both economic and noneconomic benefits which can be attributed to vocational training. A benefit can be defined as any result of the vocational education process that increases individual or social welfare. This increase in welfare can be either economic or noneconomic. With respect to economic welfare, benefits occur either directly, by increasing productivity, or indirectly, by freeing resources for alternative uses. Increasing productivity, as a result of education, implies more output per unit of input than before. The increase of productivity may in turn increase the

wage rate of vocational graduates. In this sense, vocational education can be considered an investment program.

With respect to noneconomic welfare, the educational process may result in an increased level of satisfaction for those participating in the educational process. The possible reduction of undesirable social behaviors or crimes as a result of education, the improvement of citizenship, and greater job satisfaction are also considered noneconomic benefits. Job satisfaction is more particular to vocational education, while the other benefits are applicable to all types of educational programs, although they may vary in degree. These values may not be qauntifiable in monetary terms. To ignore these noneconomic benefits, however, and concentrate on economic benefits, is to underestimate the total benefit of vocational education.

Measurement difficulties have limited the majority of researchers to the consideration of economic benefits only. Economic benefits are predominantly measured by the level of worker earnings. Kaufman, Hu, Lee, and Stromsdorfer (1967) and Swanson (1976) utilized both earning and wage rates as measures of economic benefits.

Hamby, Harper, and Myers (1978) performed a cost-benefit analysis in Montana in an attempt to include nonpecuniary benefits. Those were measured on students' utility of their training, employers' assessment of the quality of their employees' training and students' perceptions of the quality of their life.

Kaufman, Hu, Lee, and Stromsdorfer (1976) also included nonpecuniary benefits in their research. They utilized citizenship (voting

participation) and job relatedness to one's education program as criteria of nonpecuniary benefits in vocational education. Marson, Weiner, and Sorenson (1978) included study habits, personality traits, self-assessments of ability, attitudes toward education and employment, help from the school in job placement, permanence of job, job satisfaction, involvement in community organizations, number of promotions, and length of job search, in their study, while Ghazalah (1972) measured job satisfaction, work attitude, communication skills, interpersonal relationships, and self-confidence. Swanson (1976) and Kaufman and Lewis (1968) used job satisfaction as a measure of nonpecuniary benefits in their study, while Karnes (1966) used holding power, which is the inverse of the dropout rate, as a measure of educational benefits in his study. So, it is apparent that various factors were included in measuring nonpecuniary benefits from one researcher to the next.

Review of Major Findings of Cost-Benefit Analysis

The major purpose of cost-benefit study is to analyze or compare the costs and benefits of educational programs or institutions. This section of the review will focus separately upon costs and benefits of the previous studies.

Cost analysis

Most cost-benefit and cost-efficiency studies of vocational education examined the efficiency by measuring the added costs, the difference between vocational and nonvocational programs, of vocational education

(Aldrich, 1972; Cohn et al., 1972; Doty et al., 1976; Nystrom and Hennessy, 1975). Few studies investigated the efficiency of vocational education in terms of the marginal and average costs of vocational education and the optimum size of the program (Cohn et al., 1972; Hu et al., 1969; Osburn and Goishi, 1974). Concerning geographic factors, some studies were conducted on a city-wide basis (Corazzini, 1968; Hu et al., 1969; Kaufman and Lewis, 1968; Taussig, 1968). During the recent decade, most studies were conducted on a state-wide basis (Cohn et al., 1972; DeVore and Scott, 1974; Doty et al., 1976; Harris, 1972; Koch, 1972; Ohio State Department of Education, 1975; Webb, 1974).

Swanson (1976) conducted a study in Buffalo, New York, to compare the costs and benefits of vocational education. The occupational programs from four school districts were investigated based on 1972-73 data. In his study, both marginal costs and economies of scales were considered. It was found that a wide range of average costs of vocational education existed, from $712 per student for the agriculture program (with 150 students in the program) to $3,935 for horticulture (with only 9 students). The marginal costs per vocational student were $379 for the agriculture program and $3,607 for the horticulture program.

In research conducted by Doty (1976) in New Jersey, it was found that the average daily enrollment is a better measurement than the average daily attendance when measuring the average costs. Since personnel and equipment exist in the program regardless of whether a registered student is attending the school or not. Joint costs estimations were separated at the school district level (administration costs), building

level, and vocational program level. Among the 12 schools in the study, the cost for a student in general education was about $4,035 for a two-year period (1973-75), while the cost for a vocational student for the same two-year period was $4,799.

Ohio State Department of Education (1975) conducted a study to investigate the operating costs of secondary level vocational education in Ohio based on the data of 1973-74 academic year. It was found that average costs per vocational program class (with 22 students) were $26,344 or $1,197 per student. In terms of cost per student hour, it was $1.56 for vocational students and $1.24 for nonvocational students.

Nystrom and Hennessy (1975) compared the costs per credit hour ratio between vocational and nonvocational programs from 20 regular secondary schools and 5 vocational secondary schools in Illinois. They found that vocational education was about twice as expensive as nonvocational programs.

Based on the Missouri data, a study by Osburn and Goishi (1974) examined the factors influencing costs among area vocational schools. The study dealt with the economies of scale by estimating average cost function. The size of the program was defined as full-time equivalent students. The estimated optimum size of vocational school was about 400 to 500 students. A total cost function was estimated to measure the marginal costs of additional vocational students, about $145 during the 1968-69 period.

Harris (1972) conducted a cost analysis of secondary vocational education in six Tennessee schools. He used course, program and cost

categories based on enrollments and capacity of enrollments as an index to estimate the cost. It was found that total costs per pupil contact hour ranged from less than $1 to $2. A statewide survey of Michigan secondary schools (Cohn et al., 1972) revealed that the average costs per student hour for vocational education and nonvocational education programs were $278 and $187, respectively. Thus, the added cost ranged from a low of $15 for home economics to $365 for welding programs. Marginal costs of vocational and nonvocational programs were also estimated. These costs ranged from $157 to $187 per student hour for nonvocational programs. For vocational programs, the range was from $24 to $648.

Hu and others (1969) conducted a study of the costs of secondary vocational education based on Baltimore, Detroit, and Philadelphia; data covered the period of 1956 through 1960. Total educational costs were computed on the basis of estimates of both current and capital costs. Added costs of vocational education were obtained by subtracting average costs for secondary comprehensive schools from their vocational school counterparts. The estimated average costs for vocational education were $156 in Detroit and $116 in Philadelphia.

A study was conducted by Corazzini (1968) in Worcester, Massachusetts. Per pupil costs for vocational programs with costs for pupils in basic high school programs in 1963-64 were compared. It was found that a significant difference in per pupil cost between basic high school programs and vocational programs existed. Cost for students in basic programs averaged $452 compared to $964 for traditionally male vocational school programs and $793 for traditionally female vocational

school programs. The differences in costs were attributed principally to differences in teachers' salaries per pupil in basic and vocational education programs. He re-estimated costs by including adjustments for public implicit costs, that is, capital costs and property tax costs. The addition of public implicity costs raised the cost estimates by $80 per pupil for basic high school education, and $246 per pupil for the male vocational school programs, increasing further the difference between vocational and basic high school costs. Taussig (1968) conducted a similar study in New York City for the 1964-65 period. He estimated the combined current and capital annual costs per pupil and, from these data, the average added costs of vocational education. It was shown that per student costs were $1,188 for academic schools and $1,697 for vocational schools, a difference of $509.

It is apparent and well-known that costs of vocational education are higher than those for nonvocational educational programs, yet questions still exist over the magnitude of the added costs of vocational education, and what are the main influencing factors of cost difference? Most previous studies showed that the range of cost difference between vocational and nonvocational education was from $100 to $700 per student. And these studies also illustrated that teachers' salaries, equipment and the size (number of students) of the program were the most influential factors to increase the costs of vocational education. It was also shown that the costs were quite different among vocational programs. Certain vocational programs, such as home economics, were no more expensive than nonvocational programs.

Benefits analysis

Since noneconomic benefits of vocational education cannot be quantified by appropriate mathematical techniques for comparing costs to benefits, most earlier studies of cost-benefit of vocational education emphasized economic benefits and ignored noneconomic benefits. During the past decade, some studies which emphasized the noneconomic benefits of vocational education were conducted (Eninger, 1972; Hu et al., 1969; Kaufman and Lewis, 1968; Lee, 1976; Sparks, 1977; Swanson, 1976).

Marson (1978) conducted a cost-benefit analysis of nine vocational education programs and 63 adult education courses from three vocational schools in Wisconsin. He provided a detailed format for calculating costs and benefits of vocational education, including student opportunity costs and noneconomic benefits of vocational education. Marson concluded that vocational education is a worthwhile investment, based on the benefit-cost ratio and other investment criteria. In terms of noneconomic benefits, such as the percent of job satisfaction among vocational graduates and nonvocational graduates (83% versus 82%) were estimated.

A New York study by Swanson (1976) was based on eight-year longitudinal information from four school districts. Sixteen occupational programs were investigated in Buffalo. It was found that male vocational graduates have higher earnings than male nonvocational graduates. But the female vocational graduates gained less than nonvocational female graduates after the fourth year of graduation. The study results also

showed that 73% of the vocational graduates were willing to take the program again if offered, while 60% of the nonvocational graduates were willing to retake the program. Job seeking time was more favorable for vocational graduates than nonvocational graduates. And he found that not all vocational programs paid off the training, depending upon the nature of the program and the demand condition of the job market.

Lee (1976) conducted a nationwide survey of vocational education graduates that was initiated in 1971. His survey indicated that there was 15% unemployment among vocational graduates employed in 1975, while the total labor force unemployment rate at that time was 19.9% for the 16-24 year age group. And the unemployment rate for vocational program graduates in 1976 was 11.5%, which was 5.5% lower than the national average for the comparable age group (16-24 years old).

Ghazalah (1975) conducted a study to investigate the economic return and noneconomic benefits of vocational education. He estimated the present net social value of a vocational program versus the present net social value of an academic program. Ghazalah pointed out that increasing the participation rate of senior high school students in vocational programs to 40% of the average daily attendance in all 103 vocational planning districts in Ohio would result in a statewide increase in net social benefits from $109 million to $327 million. He also found that the size of benefits depended upon the alternative to vocational education (taking the academic program or dropping out), characteristics of program enrollees (male or female), and the size of the program.

A study by McNelly and Kazanas (1975) in Missouri found that cooperative vocational education has a higher benefit-cost ratio (9:1 to 10:1) than in-school vocational education (2:1 to 7:1), discounted by either 8 to 10% of the discount rate. The in-school benefit-cost ratio can be calculated either by including the program earnings or otherwise. Benefits of both programs are higher than their respective costs.

DeVore and Scott (1974) conducted a comparison study in Kansas based on the 1970 census to investigate the earnings of 14 Kansas vocational school graduates. It was found that per student return would be $269 in wages earned above and beyond the high school graduates, and it requires 2.41 years to pay back the costs of the vocational investment. Koch (1972) had conducted a similar study in five Illinois junior college vocational programs. The return rate was calculated for these programs. He pointed out that 12.3% for the private rate of return and 8.9% for the social rate of return. Koch used the U.S. Treasury bill rate (3.7%) and U.S. Treasury note rate (6.2%) as the comparison benchmark. Obviously, the investment in vocational education had a higher return than investment in the money market during that time period.

A national study by Eninger (1972) obtained from 34,710 high school graduates in 1975 from major cities of more than 250,000 population investigated both economic and noneconomic benefits of vocational education. His study showed that, among vocational graduates, about 43% were employed full time, while 34% of academic graduates were employed full time. Vocational graduates were able to get a job in a shorter time

period than nonvocational graduates. In terms of economic benefits, although hourly earnings of vocational graduates are slightly higher than those of nonvocational graduates, the difference is small, about .05 to .15 per hour difference. Fernback and Somers (1970) also conducted a national study. It was indicated that vocational graduates earned an average of $667 more during the first year than secondary academic graduates did. The total social costs of vocational education amounted to an average of about $270 per year, and the average rate of return to vocational education was about 21.4%. If the rate of discount was 10%, the net present value of benefits for vocational education was $2,484 per vocational graduate.

A study by Hu and others (1969), based on Detroit and Philadelphia data during the period of 1956 through 1960, found that vocational graduates earned an average of $343 and $643 more per year than did comprehensive graduates in two cities. Concerning the total costs of vocational education, the average rate of return to vocational education was approximately 8.2% for Philadelphia, and 31.8% for Detroit. If the rate of discount was 10%, the net present values of benefits were zero and $1,102 for the two cities, respectively. In terms of noneconomic benefits, Hu found that vocational education is generally more immediately relevant to the vocational graduate's job than education is to the job of the academic graduate. And there was no significant difference between vocational and academic graduates in terms of voting participation.

Corazzini (1968) used samples of male students from the 1963-64 period in Worchester, Massachusetts, to investigate the economic benefits

of vocational education. He found that vocational graduates earned $312 more per year than other comprehensive high school graduates. Considering costs of training difference vocational education received about a 17.9% rate of return or a $412 net present value. In the same year, Taussig (1968) used New York City vocational graduate data conducting a similar study. It was found that vocational education had a rate of return of only 5 to 7%, with almost negative present value of benefits.

Eninger's study (1967) based on the 1953-65 Project Talent data found that vocational graduates earned $375 more per year than their college preparatory counterparts. Given the total resource costs per vocational student, about $570 per year, the rate of return to vocational education was 13.8%, and the net benefits (discounted at the 10% rate) were $307 per student.

Few studies on comparison of postsecondary vocational graduates and secondary academic graduates have been conducted. Fernback and Somers (1970) found that a postsecondary vocational graduate earned about $996 per year more than secondary academic graduates. The average total costs per postsecondary vocational graduate were $3,000 per year. The calculated rate of return to postsecondary vocational education was 6.8%, and the negative net benefit was calculated by using a 10% rate of discount. But Carroll and Ihnens' study (1967) found a 16.5% rate of return to postsecondary vocational graduates, and $5,157 net present benefits.

Although many studies have been conducted to investigate the economic and noneconomic benefits of vocational education, most previous

studies lack rigorous statistical techniques to control for the confounding factors, such as race, sex, location, among vocational and nonvocational graduates, and a great variety of estimates of costs and benefits due to different methods of computing costs and benefits and different study samples employed. An appropriate technique needs to be explored and recognized. Lacking this technique, a simple comparison of economic and noneconomic benefits between vocational and nonvocational graduates may be misleading.

Review of Cost-Benefit Studies in Taiwan

Four studies on cost-benefit of vocational education or education have been conducted during the past two decades in Taiwan.

Kang and Sun (1965) were pioneers in investigating the costs and benefits of education in Taiwan. They estimated the rate of return for primary education, secondary education (34%) and higher education (28.5%). In this study, they ignored opportunity costs and private direct costs. It was inevitable to overestimate the rate of return for these three levels of education. Many educators also criticized the formula which they employed to calculate the benefits of different levels of education. However, the beginning of studying cost-benefits of education had been initiated in this country.

Gannicott (1971) conducted a study of the costs and benefits of education in Taiwan. This study was sponsored by the Ministry of Education of R.O.C. A total of 2,939 males were selected to compare both social rate of return and private rate of return among primary education,

junior high education, comprehensive senior high education, vocational education and college education. Total educational costs were computed on the basis of social costs, opportunity costs, and private costs which were provided by the Ministry of Education. He also employed age, level of education, father's occupation, public or private employer and trade to correct earnings of graduates of different levels of education. It was estimated that vocational education had 13.2% for the social rate of return and 13.2% for the private rate of return. In the meantime, comprehensive senior high education gained 12.6% for the social rate of return and 1.7% for the private rate of return.

A study by Cheng (1975), based on the 1971 data, examined the rate of return of education in different levels. She found that the average rate of return to vocational education and comprehensive senior high education was 31.77% and 29.9%, respectively. When 10.75% discount rate was used, the net rate of return was 5.5% and 5.31%, respectively. Cheng also found that the benefit of vocational education was the highest among different levels of education.

Lee (1978) conducted a national costs and benefits study for different kinds of vocational education. A total of 188 male students and 108 female graduates were compared. In this study, unemployment rate and tax rate were employed to correct the private direct costs, opportunity costs, and social costs. It was found that the junior college has higher private direct costs (NT$9,147) than the vocational high school (NT$3,604). In terms of the opportunity costs, the junior college was NT$112,008 per student, and the vocational high school was NT$63,432.

Lee's study estimated both economic and noneconomic benefits. When using 10% discount rate, junior college and vocational high schools had higher private present net value (NT$65) than comprehensive high schools (NT$-70). Concerning the social present net value, the vocational high school (NT$70) led the junior college (NT$54) and the comprehensive high school (NT$-74). Lee also calculated the internal rate of return, 22.3% private internal rate of return for the vocational school, 21.4% and 7.1% for the junior college and the comprehensive high school, respectively. Meanwhile, the vocational high school also led the social internal rate of return (22.7%) over the junior college (20%) and the comprehensive high school (7.4%). In terms of noneconomic benefits, among vocational graduates, about 91.84% were employed full time, while 91.84% of the junior college graduates and 89.19% of the comprehensive high school graduates were employed full time. Junior college graduates had higher satisfaction for their present jobs (61.22%) than the vocational graduates (56.45%) and the comprehensive high school graduates (45.9%).

Summary

Cost-benefit analysis is one of several important methods for evaluating and improving resource allocation in the area of vocational education. However, cost-benefit analysis is not a substitute for managerial judgment. Rather, it is a contributing factor to making sound management decisions, it can help increase the information available to a policy-maker which results in superior decisions to those based solely on subjective judgment.

Cost-benefit analysis is an evaluative process which relates the benefits of an investment choice to the costs which are invested. There are four basic techniques which have been developed for computing the costs and benefits relationship of an investment. These four techniques are: (1) net present value (NPV) method, (2) benefit-cost ratio (BCR) method, (3) rate of return (RR) method, and (4) payback period (PBP) method. Each method has particular strengths and limitations. There are numerous tradeoffs in the strengths and weaknesses of the various analytic techniques to relate program costs to benefits, therefore, an adequate understanding of the properties of the selected method is important to a researcher who employs cost-benefit technique in his/her study. Since the appeal of one method versus another is subjective, and because various methods may lead to differing results, it is logical that a researcher employ multiple evaluation measures in his/her cost-benefit study.

Measuring the specific costs and benefits of vocational education programs is subjective to numerous difficulties. On the cost side, these difficulties include the calculation of joint costs, capital costs, and opportunity costs. Problems in benefits measurement include measuring the investment and consumption components of vocational education, determining unbiased estimates of income differentials, conceptualizing the impact of an earning multiplier effect and operationalizing noneconomic benefits.

The review of the research literature provided this researcher insight into the nature and scope of previous research studies and directed

the researcher's efforts in the development of the design of the study as well as the development of the questionnaire. The following elements were summarized as the framework of this cost-benefit study:

1. Costs: Costs of vocational education were defined as the value of resources used for a vocational program. Costs in this study included operational costs, capital costs, and opportunity costs. Operational costs were defined as the costs of operating the program in a given year. Operational costs were subdivided into two groups, instructional costs and support costs. Instructional costs included costs for instructor, instructional resources, and student services while support costs included administration costs, costs of plant maintenance, costs of plant operation, fixed charge, and costs of other services. The capital costs were defined as any investment in fixed assets. These costs included building costs, land acquisition costs, and costs for major equipment. The opportunity costs were defined as the cost of any activity which is to forego the opportunity to undertake another activity. The opportunity costs of a vocational program included foregone income and the costs of using the plant for alternative purposes.
2. Benefits: Benefits were defined as any results of vocational programs that increase individual or social welfare. The increase in welfare can be either economic or noneconomic. the economic benefits of vocational education were defined as the change in economic welfare of society (social benefits) and the

individual's (private benefits) caused by vocational education. The economic benefits included annual income, fringe benefits, such as health insurance, vacations with pay, and other monetary benefits. The noneconomic benefits of vocational education were defined as the change of welfare other than economic welfare caused by vocational education. these benefits include the following eleven welfares: (a) higher educational effectiveness of a program, (b) greater job opportunities, (c) higher job satisfaction, (d) job permanence, (e) higher social involvement, (f) higher voting participation, (g) more productive leisure time usage, (h) positive work attitude, (i) greater sense of well-being, (j) positive attitude related to change, and (k) better social adjustment.

The researcher gained many insights into the perplexities and limitations of previous research attempts at quantifying cost-benefit analyses for the educational enterprise. Some of these insights provided by previous researchers greatly expanded the horizon and cautions necessary in deriving meaningful evaluation results for the decision and policy makers.

CHAPTER III. METHODOLOGY

This chapter contains a summary of the procedures adopted for the study. The procedures have been divided into the following sections:

(1) Definition of the population and identification of sample.

(2) The development of the instrument.

(3) Data collection and recording.

(4) Data analysis.

Definition of the Population and Identification of Sample

The study was designed to investigate and compare costs and benefits between cooperative and in-school method of vocational-industrial high schools in the occupational areas of machine shop, electricity, furniture making and printing in Taiwan. The target population, therefore, included all graduates who graduated from these programs in vocational industrial high schools in Taiwan.

Due to the longitudinal cohort survey that was employed in this study, respondents may not have remembered accurately information related to a previous time, and such errors are likely to become larger as the researcher delves further into the past (Borg and Gall, 1979). On the other hand, the study needs to use the data of a long-enough period for computing worklife earnings of the graduates. A compromise was made and, therefore, those graduates who have had five years working experience in industry were selected to be the research sample. Based on this criterion, the graduates who graduated from these two programs in 1977

were selected (every male citizen in Taiwan has 2 years of service obligation after graduating from high school). Research sample was chosen from 20% of the population (1,504 graduates) by using a multistage cluster sampling technique. Multistage cluster sampling is a variant of cluster sampling. In essence, it consists of two or more cycles of listing and sampling. In this study, the cluster sampling unit is a school. Ten vocational industrial high schools which produced graduates in both cooperative and in-school programs in 1977 served as the target school population. Six of them were selected randomly from the ten target schools. Once the schools had been randomly selected from the target schools, the researcher further reduced the sample size by only studying a random sample in each selected school. Three hundred (300) graduates were identified as the sample to be included in this study. In examining the final sample, it is apparent that the sample reflects a provincial distribution and contained a mix of public and private institutions. Table 3 shows the population distribution and Table 4 shows the sample distribution of this study.

Development of the Instrument

The instrument used to gather the data for this study is the Cost-Benefit Survey Form which is included in Appendix A. It is a self-administered questionnaire consisting of three sections. The first section of the questionnaire contains basic data designed to identify the type of program, occupation field preparation program in school, overall

Table 3. The population distribution

	Cooperative program		In-School program	
	Public	Private	Public	Private
Machine shop	186	290	200	290
Electricity	79	68	80	70
Furniture making	69	--	60	--
Printing	57	--	55	--
Subtotal	391	358	395	360
TOTAL	1,504			

Table 4. The sample distribution

	Cooperative program		In-School program	
	Public	Private	Public	Private
Machine shop	37	58	37	58
Electricity	16	14	16	14
Furniture-making	14	--	14	--
Printing	11	--	11	--
Subtotal	78	72	78	72
TOTAL	300			

graduation rank in school, school organization status, father's occupation and educational background, marital status, employment status, employment location, organization status of employment, and on-the-job training experience. These basic data served as the independent variables of this study.

The second section of the questionnaire requested each respondent to list the costs they incurred while attending school. The costs included tuition, books, school fees, transportation and residence. These costs data were used to calculate the private costs. In addition, social costs and opportunity costs were collected from the expenditure records of these six sample schools and government statistical data.

The third section is composed of a series of 17 questions and 30 items of attitude statement were designed to collect the information which was used to compute economic benefits and investigate noneconomic benefits of these two programs. The economic benefit items required respondents to list their five years of average monthly salaries after entering the job market. These data were necessary for estimating the present value of benefit, cost benefit ratio, payback period, and rate of return. As to the noneconomic benefits aspect, the items included the information regarding educational effectiveness, job opportunities, job satisfaction, job permanence, social involvement, voting participation, leisure time usage, work attitude, sense of well being, attitude related to change, and social adjustment.

The initial draft of the questionnaire was reviewed for content validity, plausibility of items, appropriateness, and to determine if the

item adhered to the principles of questionnaire construction. The review was conducted by experts. The questionnaire was revised based on the recommendations of the experts on the campus of Iowa State University. For the reason of direct communication, the second draft of the questionnaire was translated into Chinese for local distribution. Ten experts from National Taiwan Normal University were requested to review the questionnaire and to weigh eleven dimensions of noneconomic benefits. Their recommendations were used to revise the questionnaire and to weight the dimensions of noneconomic benefits. In order to determine its usability, the third draft of the questionnaire was pilot tested in Taipei, Taiwan. Twenty-four graduates who graduated from an in-school program in 1983 and twenty-five graduates from cooperative programs during the same year comprised the pilot sample. The response and comments on the pilot tested questionnaire were reviewed and the reliability was computed on selected items. The internal reliability (KR20) of these items is 0.716. Many demographic items did not need to be tested or revised.

Collection of Data

In order to have high questionnaire return rate, the researcher returned to Taiwan to collect the data. Prior to the collection of the data, the researcher requested the support and cooperation from the Department of Education, Taiwan Provincial Government. An official letter from the Department of Education in Taiwan was sent to each principal of the selected vocational-industrial high school which was identified in

the process of the sample selection. This letter explained the importance of the study, and requested the information of costs such as tuition, books, school fees, and public expenditure of 1977 school year of both programs as well as the graduate's name and address.

After the sample was randomly selected, a survey instrument was mailed to each of the research participants. Each mailing included a questionnaire (the Cost-Benefit Survey Form), a cover letter from school principal to ask for cooperation, and the explanation of the survey research. In addition, each instrument was printed with a return address and the postage for direct mailing by the respondent to the attention of the researcher.

A numerical code was affixed to each instrument for enabling the researcher to follow-up if the respondent did not return the completed instrument in two weeks. After a two-week period of time, a follow-up letter was sent to nonrespondents. Two weeks after the follow-up procedure, the second follow-up request and another instrument was sent to each of the nonrespondents. A thank you letter was also mailed to all research respondents.

The attitude items included the domains of work attitude, sense of well being, attitude related to change, and the social attitude. Thirty items were constructed to cover these dimensions. The method of successive interval was employed. The scale value was judged by sixty judges. Twenty judges were selected from teacher educators in the field of vocational education, 20 judges were selected from teachers of vocational industrial schools, and another 20 judges were selected from supervisors

or the foremen from four different industries. The background and speciality of the judges reflected the equal distribution in machine shop, electricity, furniture making and printing occupational areas. An instrument for judges was developed by emphasizing a five-point scale ("5" means a very good attitude of a graduate and "1" means a very bad attitude of a graduate). The survey of judges was conducted at Taipei, Taiwan.

The analyses of scale value were performed on a North Star Microcomputer by using the Educational Statistics Package (Miller, 1981). The scale value of these items are included in Appendix B.

Data Analysis

This section summarizes the statistical techniques used for calculating (1) costs of these two programs, (2) worklife earnings of graduates, (3) economic benefits, and (4) noneconomic benefits in this study.

The costs were calculated in this study consisting of private costs, social costs and opportunity costs. A part of the cost data was derived from survey results, and some of the costs were obtained directly from school files and governmental statistics.

Private costs of vocational education include expenditure on fees, books, travel and residence. They show exactly what costs are actually incurred by the student himself, or his family. Social costs include all expenditures on teachers' salaries, other current operating expenditures, the value of building and equipment. The opportunity cost includes student's time foregone during studying in school. After private, social,

and opportunity costs of these two methods were calculated, 0%, 5%, and 10% discounted rates were used to estimate their present discounted value (PDV). The formula for calculating present discounted value of costs is as follows:

$$PDVC = \frac{C_0}{(1+r)^0} + \frac{C_1}{(1+r)^1} + \frac{C_2}{(1+r)^2}$$

where:

PDVC = present discounted value of costs

r = discounted rate

C_0 = the costs of the first year in school

C_1 = the costs of the second year in school

C_2 = the costs of the third year in school

Since the costs and benefits data were collected from the graduates of 1977 in both methods in vocational education, therefore, the future earnings of the vocational school graduates must be interpreted from the earnings of the first five years after they entered the job market. Listed are the brief procedures for calculating the worklife earnings:

1. Calculate the average monthly earnings for each five years of employment. The average monthly earnings for the five years will be a_1, a_2, a_3, a_4, and a_5, respectively.
2. Calculate the increase rate of monthly earnings for each of the five years of employment, and get an average increase rate of monthly earnings (m).
3. The monthly earnings of the "n^{th}" year will be estimated by the formula listed below:

$$a_n = 12a_5(1+m)^{n-10} \qquad n \geq 10$$

where:

a_n = annual earnings of n^{th} year

n = the number of years from investment determining year

The first five year earnings of the participants and the above formula were input into a computer. The total worklife earnings of the graduate are the sum of the projected future earnings and the sum earnings during the first five years.

The estimated total worklife earnings were converted into a present discounted value (PDV). The basic formula for calculating present discounted value of benefits is the same as the previous one. The formula is:

$$PDVB = \frac{B_1}{(1+r)^1} + \frac{B_2}{(1+r)^2} + \frac{B_3}{(1+r)^3} + \ldots + \frac{B_t}{(1+r)^t}$$

where:

PDVB = present discounted value of benefits (worklife earning)

B_t = future benefits/earnings

r = discounted rate

t = time period

Present value of benefit, cost benefit ratio, payback period, and rate of return techniques will be used to investigate the economic benefit of these two programs.

The net present value of benefit of vocational education is the present net benefit of vocational graduate due to receiving vocational education. In other words, the present value of benefit of vocational

education equals to worklife earnings of vocational graduate minus both worklife earnings of junior high graduate and total costs. Based on this concept then;

Private net present value of benefit = (net worklife earnings of vocational graduate after tax) - (worklife earnings of junior high graduate after tax) - (private costs)

Social net present value of benefit = (worklife earnings of vocational graduate before tax) - (worklife earnings of junior high graduate before tax) - (private costs + opportunity costs + public costs)

The discount rates, 0%, 5%, and 10% were used to derive all costs and benefits to present value. These data were corrected by the unemployed rate, and Denison a coefficient.

The cost benefit ratio is calculated by determining what percent the costs have to be multiplied by in order to equal the benefits. The payback period is calculated by determining the length of time required to recoup the costs of an educational program. These calculating formulas have been described in the previous chapter.

The economic benefits derived from the above four techniques are not only contributed by vocational education, but also by other factors, such as family background, employment location, on-the-job training, etc. Therefore, a stepwise multiple regression technique was employed to investigate the relationship among these multivariates and to find out the

main factors which influenced the economic benefits of vocational education. The basic multiple regression model which was used in this study is briefly stated below:

$$Y_1 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + \ldots + b_{12}X_{12}$$

where:

Y_1 = worklife earning of graduate

X_1 = type of program, 0 = cooperative, 1 = in-school

X_2 = 1 if machine shop, else = 0

X_3 = 1 if electricity, else = 0

X_4 = 1 if furniture making, else = 0

X_5 = ability, 1 through 5

X_6 = school status, 0 = public, 1 = private

X_7 = father's occupation, 0 = white collar, 1 = blue collar

X_8 = father's education, 0 through 20

X_9 = married = 1, single = 0

X_{10} = employment location, 0 = rural, 1 = urban

X_{11} = employer status, 0 = public, 1 = private

X_{12} = weeks of on-the-job training.

As to the noneconomic benefits aspect, the items included the information regarding educational effectiveness, job opportunities, job satisfaction, job permanence, social involvement, voting participation, leisure time usage, work attitude, sense of well being, attitude related to change, and social adjustment. The responses to these items were transferred into normalized score. The average Z scores were calculated for

each dimension. Since the judges had rated each dimension of equal importance, therefore, the composite Z scores of these eleven dimensions were calculated and transformed to T score. The T scores were the scores for the noneconomic benefits of each respondent.

In order to test hypothesis 8 of this study, the stepwise multiple regression technique was employed to investigate the relationship between the noneconomic benefits and the independent variables of this study. The basic multiple regression model which was used in this study was expressed as follows:

$$Y_2 = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_{12}X_{12}$$

where:

Y_2 = noneconomic benefits of graduate

X_1 = type of program, 0 = cooperative, 1 = in-school

X_2 = 1 if machine shop, else = 0

X_3 = 1 if electricity, else = 0

X_4 = 1 if furniture making, else = 0

X_5 = ability, 1 through 5

X_6 = school status, 0 = public, 1 = private

X_7 = father's occupation, 0 = white collar, 1 = blue collar

X_8 = father's education, 0 through 20

X_9 = married = 1, single = 0

X_{10} = employment location, 0 = rural, 1 = urban

X_{11} = employer status, 0 = public, 1 = private

X_{12} = weeks of on-the-job training.

In order to test hypothesis 9 of this study, the canonical correlation technique was used to test the relationship between the benefits measurement of vocational education and the independent variables of this study. The basic model for canonical correlation analysis was expressed as follows:

$$W_1Y_1 + W_2Y_2 = b_o + b_1X_1 + b_2X_2 + b_3X_3 + \ldots + b_{12}X_{12}$$

where:

Y_1 = worklife earning of graduate

Y_2 = noneconomic benefits of graduate

X_1 = type of program, 0 = cooperative, 1 = in-school

X_2 = 1 if machine shop, else = 0

X_3 = 1 if electricity, else = 0

X_4 = 1 if furniture making, else = 0

X_5 = ability, 1 through 5

X_6 = school status, 0 = public, 1 = private

X_7 = father's occupation, 0 = white collar, 1 = blue collar

X_8 = father's education, 0 through 20

X_9 = married = 1, single = 0

X_{10} = employment location, 0 = rural, 1 = urban

X_{11} = employer status, 0 = public, 1 = private

X_{12} = weeks of on-the-job training.

The t-test was used to determine whether two means were significantly different at a selected probability level. The probability level of this study was selected at 0.05.

The Educational Statistics Package (Miller, 1981) computer program and Statistical Analysis System (SAS) computer program were used for the statistical analysis of data included in this study. The Wylber computer system was employed to compute all of the costs and benefits analysis.

CHAPTER IV. RESULTS AND FINDINGS

In this chapter, the results and findings of this study are presented. There are two sections in this chapter: (1) the results of survey response, and (2) the hypotheses testing.

Survey Response

A careful effort was made to increase the return rate of the questionnaires in the process of conducting the survey. A letter from the principal of the sample's schools was included in each mailing to request the cooperation of the graduates of this study. Three times of follow-up were conducted. Since the respondents of this study had graduated from school during the seven previous years, some factors were beyond the control of the researcher. Such variables included: geographical mobility, social change, and culture background. In this study, three hundred graduates from the vocational industrial school of cooperative and in-school instructional methods were chosen as the sample of this study. One hundred and eighty-two survey questionnaires (60.67% of 300 research samples) were returned. Fifty-seven instruments (19% of 300 research samples) were returned for the reason of no forwarding address resulting from moving or urban reconstruction. Sixty-one questionnaires (20.33% of 300 research samples) did not respond to this survey. For the reason of cultural difference, it is hard to reach the nonrespondents by phone or interview. The results of the survey response returns are shown in Table 5.

Table 5. The number and percentage of respondents

Responder		Cannot reach by mail		Without response		Total	
182	60.67%	57	19.00%	61	20.33%	300	100.00%

In a further study of the respondents return rates, it was found that one hundred and fourteen cooperative method graduates (76% of 150 samples) responded to the survey and sixty-eight in-school method graduates (45.3% of 150 samples) responded to the survey. The more detailed information about the respondents is presented in Table 6.

Table 6. The number and percentage of respondents by instructional method and the occupation for which trained

	Cooperative Method				In-School Method			
	Public School		Private School		Public School		Private School	
Machine shop	17	45.94%	53	91.38%	25	67.57%	12	20.69%
Electricity	12	75.00%	13	92.86%	11	68.75%	5	35.71%
Furniture Making	10	71.43%	--	--	6	42.86%	--	--
Printing	9	90.00%	--	--	9	81.82%	--	--
Subtotal	48	61.54%	66	91.67%	51	65.38%	17	23.61%

The returned questionnaires were carefully studied by the researcher. It was found that some of the questionnaires did not have complete information for every item. In order to have reliable results of data analysis, there were twenty-five returned questionnaires which were eliminated from analysis. Therefore, there were one hundred and fifty-seven (157) returned questionnaires which were included in the process of data analysis, ninety-six (96) questionnaires were obtained from cooperative method and sixty-one (61) questionnaires were obtained from vocational graduates subjected to in-school methods.

Hypothesis Testing

There are nine hypotheses included in this study. This section is concentrated on testing these hypotheses.

Research hypothesis 1

There is no significant difference between the costs (private and social) of cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Costs of vocational education were defined as the value of resources used for a vocational program. Costs in this study included two kinds of costs, private costs and social costs. Private costs of vocational education are the costs to the individual student which included expenditure on fees, books, travel, and housing, and the opportunity costs of students' time as measured by earnings foregone during the study period. Any scholarships or grants which cover all or some of a student's fee or maintenance costs must be deducted in order to show exactly what costs

are actually incurred by the student himself or his family. The social costs of vocational education are the costs to society which include all public expenditure on teacher's salaries, other current expenditures, the value of building and equipment, and the opportunity costs of student's time which measured by income foregone as a proxy measure of the production foregone by society while students continue their education rather than join the labor market. Therefore, research hypothesis 1 was divided into two subhypotheses as below:

Research hypothesis 1A:

There is no significant difference between the private costs of cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Research hypothesis 1B:

There is no significant difference between the social costs of cooperative an in-school instructional methods of selected programs in vocational industrial high schools.

In order to test research hypothesis 1A, the data from Item 14 to Item 20 of the Cost-Benefit Survey Form were analyzed and computed. The results of the analysis and computation were presented in Table 7.

The above costs values were further discounted to investment determination year which in Taiwan is seventeen years before a student can enter the vocational program. Rates of 0%, 5%, 10% of discount rate were used for computation purposes. The present discount value of private costs of this study were found and listed in Table 8.

Table 7. The private costs of the cooperative and the in-school instructional methods of selected programs in vocational industrial high schools (Unit = NT)

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	71,101	20,635	61	151,675	17,646

Table 8. The present discount value of private costs of cooperative and in-school methods of selected programs in vocational industrial high schools (Unit = NT)

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	71,101	20,635	151,675	17,646
5%	67,533	19,573	144,035	16,766
10%	64,376	18,641	137,310	15,992

The above values were then tested by two-tail T-test at $\alpha = 0.05$ level. The results of the T-test are summarized in Table 9.

It was found that the private costs of cooperative and in-school methods of instruction in selected programs in vocational industrial schools are significantly different at $\alpha = 0.05$ level. When 0% of discount rate was used, the private costs of cooperative method was NT$71,101 while the in-school method was NT$151,675. When 5% discount rate was used, the

Table 9. The summary of T-test of private cost of cooperative and in-school methods of selected programs in vocational industrial schools

0%	5%	10%
-25.1931**	-25.2076**	-25.2185**

For Ho: variances are equal.

**P>ITI = 0.001.

private costs using the present discount values were NT$67,533 and NT$144,035, respectively. When a 10% discount rate was used, the present discount values of the private costs were NT$64,376 and NT$137,310, respectively. It was concluded that the in-school method had significantly higher private costs than cooperative method of instruction of selected programs in vocational industrial high school in Taiwan. The null hypothesis 1A was rejected at $\alpha = 0.05$.

In order to test research hypothesis 1B, the expenditure records of six sample schools of this study (three public and three private) and other related government official documents were reviewed by the researcher of this study. The public costs of the cooperative and in-school instructional methods were calculated based on the analysis of data found in these documents. The results of the review and the computation of the data for the public school were listed in Table 10.

Upon a detailed examination of the documents of three sample private schools, it was found that the earliest available accounting record of

Table 10. Public costs of cooperative and in-school methods of selected programs of public vocational industrial high schools per student (Unit = NT)

School year	Cooperative method	In-school method
1975	7,278	8,278
1976	9,025	10,025
1977	11,528	12,528

these schools were the documents of the 1977 school year. Since there was no other source available, the researcher used the data of 1977 to infer the public costs of private school based on the experience of public schools. The results of the inference are listed in Table 11.

Table 11. Public costs of cooperative and in-school methods of selected programs of private vocational industrial high school per student (Unit = NT)

School year	Cooperative method	In-school method
1975	-1,430	-430
1976	-60	940
1977	1,836	2,836

The opportunity costs of each cooperative student were computed based on the data presented on Item 16 of the Cost-Benefit Survey Form. The opportunity costs of the in-school students were inferred from the

part-time earnings of cooperative students while still in school of the same occupation area for which he or she was being trained. Table 12 presents the calculated results of the opportunity costs of in-school students in different occupational areas and school years.

Table 12. The opportunity costs of in-school students in different occupational areas and school years (Unit = NT)

School Year	Machine Shop	Electricity	Furniture Making	Printing
1975	17,957	21,284	28,350	18,412
1976	22,883	26,463	35,525	20,174
1977	27,011	34,890	42,000	25,266

Based on the data presented above and the data obtained from the returned questionnaires (Item 14 to Item 20), the social costs of cooperative and in-school methods of selected programs of vocational industrial high school per student were computed and are listed in Table 13.

The above cost values were further discounted to investment determination year by using 0%, 5%, and 10% discount rate. The results of the computation lead to the present discount value of social costs of vocational education. The present discount value of social costs of cooperative and in-school methods of instruction in selected programs in vocational industrial schools are listed in Table 14.

Table 13. The social costs of the cooperative and the in-school methods of selected programs of vocational industrial high schools per student

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	134,877	40,774	61	149,201	14,130

Table 14. The present discount value of social costs of cooperative and in-school methods of instruction in selected programs of vocational industrial schools per student

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	134,877	40,774	149,201	14,130
5%	127,919	38,571	141,471	13,417
10%	121,797	36,640	134,672	12,793

The present discount values of social costs were then tested by a two-tail T-test at $\alpha = 0.05$ level. The results of the T-test are summarized in Table 15.

It was found that the social costs of cooperative and in-school methods of instruction in selected programs of vocational industrial schools were significantly different at $\alpha = 0.05$ level. When 0% discount

Table 15. The summary of T-test of social costs of cooperative and in-school methods of instruction in selected programs in vocational industrial schools

0%	5%	10%
-2.6422**	-2.6418**	-2.6413**

For Ho: variances are equal.

**P>ITI = 0.0091.

rate was used, the social costs of cooperative method were NT$134,877, while for the in-school method the costs were NT$ 149,201. When 5% discount rate was used, the social cost present discount values were NT$127,919 and NT$141,471, respectively. When 10% discount rate was used, the social cost present discount values were NT$121,797 and NT$134,672, respectively. It was concluded that the in-school instructional method of instruction in selected programs in vocational high school had significantly higher social costs than the cooperative instructional method. The null hypothesis 1B was rejected at $\alpha = 0.05$ level.

Research Hypothesis 2

There is no significant difference between the earnings of graduates from cooperative and in-school methods of instruction in selected programs of vocational industrial high schools during the first five years of work.

The earnings of vocational graduates during the first five years of work included the annual income and the fringe benefits, e.g., health insurance, vacation with pay and other monetary benefits from the job. These data were obtained directly from Item 30 of the returned Cost-Benefit Survey Form of this study. The data of each respondent were carefully examined and input into the computer. In order to make the necessary comparison, the average month earnings were transformed to annual earnings. The average earnings of cooperative and in-school methods of instruction of vocational industrial school graduates were computed and are listed in Table 16.

Table 16. The first five years' earnings of graduates from cooperative and in-school methods of instruction in selected programs of vocational industrial (Unit = NT)

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	673,371	12,266	61	647,725	124,570

In order to make the necessary comparison, the first five years' earnings of graduates were discounted to the investment determination year (1975) by using 0%, 5%, and 10% discount rates. The results of this analysis are presented in Table 17.

Table 17. The present discount value of the first five years' earnings of graduates from cooperative and in-school methods of instruction in vocational industrial high schools (Unit = NT)

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	673,371	120,266	647,725	124,570
5%	473,473	84,115	455,974	87,677
10%	339,885	60,199	327,704	63,026

The two-tail T-test was employed to test the difference between these two groups of data at $\alpha = 0.05$ level. The results of this test are presented in Table 18.

Table 18. The summary of T-test of the first five-year earnings of the graduates from cooperative and in-school methods of instruction in selected programs of vocational industrial high schools

0%	5%	10%
1.2849*	1.2498**	1.2134***

For Ho: variances are equal.

*P>ITI = 0.2007.

**P>ITI = 0.2133.

***P>ITI = 0.2268.

It was found that the first five years' earnings of graduates from cooperative and in-school methods of instruction were not significantly different at $\alpha = 0.05$ level. When a 0% of discount rate was used, the first five years' earnings of graduates from cooperative method were NT$673,371, while the in-school graduates were NT$647,725. When a 5% discount rate was used, then the first five years' earnings of graduates were NT$473,473 and NT$455,974, respectively. When a 10% discount rate was used, the first five years' earnings of graduates were NT$339,855 and NT$327,704, respectively. It was concluded that there was no significant difference between the first five years' earnings of graduates from cooperative and in-school methods of instruction in selected programs in vocational industrial high schools in Taiwan. Reported results failed to reject the null hypothesis at $\alpha = 0.05$ level.

Research hypothesis 3

There is no significant difference between the net present value of benefits (private and social) of graduates from cooperative and in-school instructional methods of selected programs of vocational industrial high schools.

The net present value of benefits of vocational education are the net present benefits of vocational graduates due to receiving vocational education. It includes two aspects, the private net present value of benefits and the social net present value of benefits. Therefore, research hypothesis 3 was divided into two sub-hypotheses as presented below:

Research hypothesis 3A: There is no significant difference between the private net present value of benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Research hypothesis 3B: There is no significant difference between the social net present value of benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

The private net present value of benefits of vocational education are the private net worklife earnings of vocational graduates after taxation less the worklife earnings of junior high graduates after taxation, and subtract the private educational costs of graduates. The residual benefits must be adjusted by the long term average unemployment rate and discounted to the investment determination year, 17 year old student in this case, then adjusted by Denison alpha coefficient (0.66).

The worklife earnings of vocational graduates of this study were extrapolated from the earnings of the first five years after they entered the job market. The average increase rate of earnings of each group in this study was calculated and used to predict the future earnings of each group. The sum of predicting future earnings of a graduate and the total of the first five years earnings are the predicted social worklife earnings of a vocational graduate. These amounts of earnings were adjusted by the average unemployment rate of 1950-84 (3.17% for vocational high school graduates). The residuals were the net social predicted worklife earnings of a vocational graduate which is the net change in economic

welfare of society due to the worklife participation of the job market of a vocational graduate. If the net social predicted worklife earnings are subtracted from the income tax of worklife period, the residuals will be the net private worklife earnings of a graduate of vocational education which are the change of economic welfare of an individual due to the worklife participation within the job market. The long-term average income tax rate of 1950-1980 (8% for vocational high school graduates) was used to predict the income tax of predicted worklife earnings of vocational graduates.

The computation of worklife earnings of a junior high school graduate employed the same concept and procedure as was used in computing the worklife earnings of vocational graduates. Since there was no evidence available for calculating the earnings increase rate of junior high school graduates, the researcher used the earnings increase rate of the total group of the sample to calculate the predicted worklife earnings of the junior high school graduates. The predicted worklife earnings of junior high graduates were then adjusted by 1.67% (long-term unemployment rate of junior high graduate 1950-84) and by 6% of long-term tax rate for junior high graduates. The social costs, private costs, and the opportunity costs were the same values which were used in testing hypothesis 1.

Denison (1962) who conducted a similar study on education, attributed education as a higher determinant to the gross earnings of college graduates. Denison concluded that about 66 percent of the gross earnings differentials between college and high school graduates can be

statistically attributed to education alone. Since there was no similar research study conducted in the field of vocational education in Taiwan, the researcher employed Denison alpha coefficient (0.66) to calculate the net present value of benefits of vocational education in this study. This coefficient may represent inherent cultural differences and perhaps require validation for universal application. The net private worklife earnings and net social worklife earnings were adjusted by Denison alpha coefficient, respectively.

The results of private net benefits were listed in Table 19.

Table 19. The private net benefits of cooperative and in-school instructional methods of selected programs of vocational industrial high schools (unit = thousand NT)

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	96,643.73	23,702.3	61	58,787.8	13,222.34

The private net benefits were further discounted by using 0%, 5%, and 10% discount rate to the investment determination year. The private net present value of benefits were found and are listed in Table 20.

The above values were then tested by a two-tail T-test at $\alpha = 0.05$ level. The results of the T-test are summarized in Table 21.

It was found that there was a significant difference between the private net present value of benefits of graduates from cooperative and

Table 20. The private net present value of benefits of graduates from cooperative and in-school instructional methods of selected programs of vocational high schools (Unit = thousand NT)

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	96,643.73	23,702.3	58,787.8	13,222.34
5%	17,388.898	4,173.41	11,160.31	2,435.61
10%	3,937.343	922.117	2,683.07	577.67

Table 21. The summary of T-test of the private net present value of benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational high schools

0%	5%	10%
11.3903***	10.5620***	9.4990***

For Ho: variances are equal.

***P>ITI = 0.001.

in-school instructional methods of selected programs in vocational industrial high schools at α = 0.05 level. When a 0% discount rate was used, the private net present value of benefits of graduates from cooperative instructional methods were NT$96,643.75 thousand while the in-school instructional method were NT$58,787.80 thousand. When a 5% discount rate was used, then the private net present value of benefits

were NT$17,388.898 thousand and NT$11,160.31 thousand, respectively. When a 10% discount rate was used, the private net present value of benefits were NT$3,937.343 thousand and NT$2,683.07 thousand, respectively. The null hypothesis 3A was rejected at $\alpha = 0.05$ level.

The social net present value of benefits of cooperative and in-school instructional methods were the net worklife earnings of vocational graduates before tax subtract the net worklife earnings of junior high graduate before tax, and then subtract the total costs which include private costs, opportunity costs, and public costs. The results of the computation were listed in Table 22.

Table 22. The social net benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools (Unit = thousand NT)

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	105,182.134	25,763.162	61	64,029.52	14,373.34

The above values were further discounted to the investment determination year by using 0%, 5%, and 10% discount rate. The social net present value of benefits were found and listed in Table 23.

The above values were then tested by a two-tail T-test at $\alpha = 0.05$ level. The results of the T-test were summarized in Table 24.

Table 23. The social net present value of benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools (Unit = thousand NT)

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	105,182.134	25,763.162	64,029.52	14,373.34
5%	18,914.83	4,536.12	12,140.03	2,648.55
10%	4,279.16	1,002.16	2,911.45	628.94

Table 24. The summary of T-test of the social net present value of benefits of graduates from cooperative and in-school methods of instruction in selected programs in vocational industrial high schools

0%	5%	10%
11.3915***	10.5687***	9.5274***

For Ho: variances are equal.

***P>ITI = 0.0001.

It was found that there was a significant difference between the social net present value of benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools at $\alpha = 0.05$ level. When 0% discount rate was used, the social net present value of benefits of graduates from cooperative

instructional method were NT$105,182.134 thousand while the in-school method were NT$64,029.52 thousand. When a 5% discount rate was used, then the social net present value of benefits were NT$18,914.83 thousand and NT$12,140.03 thousand, respectively. When a 10% discount rate was used, the social net present value of benefits were NT$4,279.16 thousand and NT$2,911.45 thousand, respectively. Based upon the findings, the null hypothesis 3B was rejected at $\alpha = 0.05$ level.

Research hypothesis 4

There is no significant difference between the rate of return (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools. This research hypothesis was divided into two subhypotheses:

Research hypothesis 4A: There is no significant difference between the private rate-of-return of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Research hypothesis 4B: There is no significant difference between the social rate-of-return of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

The rate of return method of cost-benefit analysis establishes the interest rate that will make the present value of the benefits equal to the present value of the costs. In other words, the rate of return is calculated by establishing a rate of discount which equates to the flow of

benefits and costs over time. Therefore, the investment options can be ranked by the magnitude of 'r'. An investment yielding a larger 'r' is preferred to an investment yielding a smaller 'r'. The equation used for computing the rate of return in this study is illustrated below:

$$RR = r \quad \text{such that} \quad \sum_{t=0}^{n} \frac{B_t - C_t}{(1+r)^t} = 0 \qquad (A)$$

Writing out equation (A), then we have

$$\frac{-C_0}{(1+r)^0} + \frac{-C_1}{(1+r)^1} + \frac{-C_2}{(1+r)^2} + 0 + 0 + \frac{B_5}{(1+r)^5} + \frac{B_6}{(1+r)^6} + \ldots + \frac{B_{44}}{(1+r)^{44}} = 0$$

In order to test hypothesis 4A, the data of private costs and private benefits were inserted into the equation (B) to calculate the rate-of-return by using a computer. The results of computing are reported in Table 25.

Table 25. The private rate-of-return of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	0.539053	0.059252	61	0.38098	0.033173

The rates of return were further tested by two-tail T-test procedures to find whether there was a difference between these two groups. The results of the T-test are summarized in Table 26.

Table 26. The summary of T-test of private rate-of-return of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Cooperative Method	In-School Method	Variance	T	P>ITI
0.539053	0.38098	equal	19.0145	0.0001

It was found that the private rate-of-return of cooperative and in-school methods of instruction in selected programs in vocational industrial schools are significantly different at $\alpha = 0.05$ level. The private rate-of-return of cooperative instructional method was 53.905% while in-school method was 38.098%. The null hypothesis 4A was rejected at $\alpha = 0.05$.

In order to test hypothesis 4B, the data of social costs and private benefits which were generated from this study were input into a computer to calculate the social rate-of-return. The results of computing these costs are listed in Table 27.

The social rate-of-return was further tested by two-tail T-test procedures to find whether there was a difference between these two groups. The results of the T-test are summarized in Table 28.

Table 27. The social rate-of-return of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	0.419644	0.047986	61	0.384616	0.033253

Table 28. The summary of T-test of social rate-of-return of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Cooperative Method	In-School Method	Variance	T	P>ITI
0.419644	0.384616	equal	4.9880	0.0001

It was found that the social rate-of-return of cooperative and in-school methods of instruction from selected programs in vocational industrial schools are significantly different at $\alpha = 0.05$ level. The social rate-of-return of cooperative instructional method was 41.96% while the in-school method was 38.46%. The null hypothesis 4B was rejected at $\alpha = 0.05$ level.

Research hypothesis 5

There is no significant difference between the benefit-cost ratio (private and social) of graduates from cooperative and in-school

instructional methods of selected programs in vocational industrial high schools.

This hypothesis was further divided into two subhypotheses.

Research hypothesis 5A: There is no significant difference between the private benefit-cost ratio of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Research hypothesis 5B: There is no significant difference between the social benefit-cost ratio of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

The benefit-cost ratio (BCR) method of cost-benefit analysis is theoretically similar to the net present value method. Both methods discount the flow of costs and benefits to their present values. However, the benefit-cost ratio method gives the decision-maker an indicator of the efficiency of a program. In all cases, this ratio has to be larger than '1' for an educational program to be beneficial. The equation for calculating the benefit-cost ratio is shown as illustrated below:

$$BCR = \frac{\sum_{t=0}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=0}^{n} \frac{C_t}{(1+i)^t}}$$

In order to test research hypothesis 5A, the private benefit-cost ratio was calculated by input of the private benefits and the private costs into the above BCR equation. The computation was performed by a computer. The results of computer output were summarized in Table 29.

Table 29. The private benefit-cost ratio of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	2606.0879	776.832	61	735.1293	165.0657

These private benefit-cost ratios were further discounted to investment determination year by using the 0%, 5%, and 10% discount rates. The results of the computation lead to the present discount value of private benefit-cost ratio of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools. These values are presented in Table 30.

The present discount values of private benefit-cost ratio were then tested by a two-tail T-test at $\alpha = 0.05$ level. The results of the T-test are summarized in Table 31.

It was found that the private benefit-cost ratio of cooperative and in-school methods of instruction in selected programs of vocational industrial schools were significantly different at $\alpha = 0.05$ level. When

Table 30. The present discount values of private benefit-cost ratio of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	2606.0879	776.832	735.1293	165.0657
5%	485.6266	144.7889	143.0889	32.0584
10%	114.3896	34.0203	35.9721	8.0202

Table 31. The summary of T-test of private benefit-cost ratio of cooperative and in-school methods of instruction in selected programs in vocational industrial schools

0%	5%	10%
18.5262***	18.1763***	17.6741***

For Ho: variances are equal.

***P>ITI = 0.0001.

0% discount rate was used, the private benefit-cost ratio of cooperative method was 2606.08, while in-school method was 735.13. When a 5% discount rate was used, the private benefit-cost ratios were 485.63 and 143.09, respectively. When a 10% discount rate was used, the private benefit-cost ratios were 114.39 and 35.97, respectively. It was concluded that the graduates from cooperative method of instruction of

selected programs in vocational industrial high schools had significantly higher private benefit-cost ratio than the graduates from in-school method did. The null hypothesis 5A was rejected at $\alpha = 0.05$ level.

In order to test research hypothesis 5B, the social benefit-cost ratio was calculated by the input of social benefits and social costs into the BCR equation. The computation was also performed by a computer. The results of computer output were summarized in Table 32.

Table 32. The social benefit-cost ratio of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	1378.1623	404.2715	61	746.1175	168.8327

This social benefit-cost ratio was further discounted to investment determination year by using a 0%, 5%, and 10% discount rate. The results of the computation lead to the present discount value of social benefit-cost ratio of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools. These values are presented in Table 33.

The present discount values of social benefit-cost ratio were then tested by a two-tail T-test procedure at $\alpha = 0.05$ level. The results of the T-test are summarized in Table 34.

Table 33. The present discount values of social benefit cost ratio of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	1378.1623	404.2715	746.1175	168.8327
5%	257.1138	75.3749	145.4521	32.8471
10%	60.6383	17.7242	36.6172	8.2156

Table 34. The summary of T-test of social benefit-cost ratio of cooperative and in-school methods of instruction in selected programs in vocational industrial schools

0%	5%	10%
11.5755***	10.9207***	9.9209***

For Ho: variances are equal.

***P>ITI = 0.0001.

It was found that the social benefit-cost ratio of cooperative and in-school methods of instruction in selected programs of vocational industrial schools were significantly different at = 0.05 level. When a 0% discount rate was used, the social benefit-cost ratio of cooperative method was 1378.16 while the in-school method was 746.12. When a 5% discount rate was used, the social benefit-cost ratios were 257.12 and

145.45, respectively. When a 10% discount rate was used, the social benefit-cost ratios were 60.64 and 30.62, respectively. It was concluded that the graduates from cooperative method of instruction of selected programs in vocational industrial high schools had a significantly higher social benefit-cost ratio than the graduates of in-school method attained. The null hypothesis 5B was rejected at $\alpha = 0.05$ level.

Research hypothesis 6

There is no significant difference between the payback period (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

The payback period method of cost-benefit analysis is determined simply by calculating the length of time required to recoup the costs of an educational program. The individual will recoup the costs of the educational process through increasing the earnings after his/her entry into the job market, while the society will recoup the costs through the accumulated increase of the economic welfare, such as increasing the tax revenue, or increasing the productivity. Therefore, the investment options can be ranked by the length of payback period. With an investment yielding a short period of payback preferred to an investment yielding a longer payback period. The equation for calculating the payback period for this study is shown as illustrated below:

$$\text{Payback period} = N \quad \sum_{t=5}^{n} \frac{B_t}{(1+i)^t} - \sum_{t=0}^{2} \frac{C_t}{(1+i)^t} = 0$$

There were two kinds of payback periods, the private and the social, therefore, research hypothesis 6 can also be divided into two sub-hypotheses as the following:

Research hypothesis 6A: There is no significant difference between the private payback period of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Research hypothesis 6B: There is no significant difference between the social payback period of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

In order to test research hypothesis 6A, the private payback period was calculated by the input of the private costs and the private benefits into the above payback equation. The results of the calculation are presented in Table 35.

Table 35. The private payback period of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools (Unit = months)

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	8.9425	2.9308	61	18.0975	3.5646

In order to make necessary comparisons, the private payback periods were further computed by using the discount rate of 0%, 5%, and 10% to investment determination year. The results of the computation are listed in Table 36.

Table 36. The present discount value of private payback periods of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools (Unit = months)

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	8.9425	2.9308	18.0975	3.5646
5%	10.7475	3.4332	22.0169	4.3503
10%	12.8555	4.0822	26.9254	5.4284

The present discount values of private payback periods were then tested by a two-tail T-test at $\alpha = 0.05$ level. The results of the T-test are summarized in Table 37.

It was found that the private payback periods of cooperative and in-school methods of instruction in selected programs of vocational industrial schools were significantly different at $\alpha = 0.05$ level. When a 0% discount rate was used, the private payback period of cooperative method was 8.94 months while the in-school method was 18.10 months. When a 5% discount rate was used, the private payback periods were 10.75 months and 22.02 months, respectively. When a 10% discount rate was

Table 37. The summary of T-test of private payback periods of cooperative and in-school methods of instruction in selected programs in vocational industrial schools

0%	5%	10%
-17.5212**	-18.0435***	-18.4804***

For Ho: variances are equal.

***P>ITI = 0.0001.

used, the private payback periods were 12.86 months and 26.93 months, respectively. It was concluded that the graduates from the cooperative method of instruction of selected programs in vocational industrial high schools had a significantly shorter private payback period than the graduates from the in-school method did. The null hypothesis 6A was rejected at $\alpha = 0.05$ level.

In order to test research hypothesis 6B, the social payback period was calculated by the input of social benefits and social costs into the payback period equation. The computation was performed by a computer. The results of the computation are presented in Table 38.

The social payback period of graduates from cooperative and in-school instructional methods were further discounted to investment determination year by using 0%, 5%, and 10% discount rate. The results of the computation lead to the present discount values of social payback period of graduates from vocational industrial high schools. These values are presented in Table 39.

Table 38. The social payback period of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools (Unit = months)

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	16.0869	5.2659	61	17.8506	3.3735

Table 39. The present discount value of social payback periods of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools (Unit = months)

Discount rate	Cooperative Method		In-School Method	
	Mean	SD	Mean	SD
0%	16.0869	5.2659	17.8506	3.3735
5%	19.3556	6.3426	21.6931	4.1512
10%	23.4006	7.7912	26.4879	5.2062

The present discount values of social payback periods were then tested by a two-tail T-test at $\alpha = 0.05$ level. The results of the T-test are summarized in Table 40.

It was found that the social payback periods of cooperative and in-school methods of instruction in selected programs of vocational industrial schools were significantly different at $\alpha = 0.05$ level. When a

Table 40. The summary of T-test of social payback periods of cooperative and in-school methods of instruction in selected programs in vocational industrial schools

0%	5%	10%
-2.3283*	-2.5506**	-2.7125***

For Ho: variances are equal.

*P>ITI = 0.0212.

**P>ITI = 0.0117.

***P>ITI = 0.0074.

0% discount rate was used, the social payback period of cooperative method was 16.09 months while the in-school method was 17.85 months. When a 5% discount rate was used, the social payback periods were 19.36 months and 21.69 months, respectively. When a 10% discount rate was used, the private payback periods were 23.40 months and 26.49 months, respectively. It was concluded that the graduates from the cooperative method of instruction of selected programs in vocational industrial high schools had a significantly shorter social payback period than the graduates from the in-school method did. The null hypothesis 6B was rejected at $\alpha = 0.05$ level.

Research hypothesis 7

There is no significant difference between the noneconomic benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Noneconomic benefits of vocational education were defined as the change of welfare other than economic welfare caused by vocational education. The noneconomic benefits were further divided into two types of benefits in this study. The first type of benefits are those benefits which related specifically to the job environment, such as: dimensions of educational effectiveness, job satisfaction, job permanence, and work attitude. The second type of measurement of noneconomic benefits dealt with the socialization effects of vocational education, such as: the dimensions of social involvement, voting participation, leisure time usage, sense of well-being, attitude related to change, and social adjustment. The data of noneconomic benefits measurement were collected from the returned questionnaires of this study. The score of each dimension was recorded and computed with the aid of a North Star microcomputer. The Educational Statistics Package (Miller, 1981) was used to analyze the data. Each dimension was scored and transferred into a Z score. These eleven dimensions included in the noneconomic benefits measurement were then computed to generate a composite Z score and further to a composite T score. The results of the computation were presented in Table 41.

The scores of noneconomic benefits of graduates from cooperative method and in-school method of selected programs in vocational industrial high schools were further tested by a two-tail T-test procedure at α = 0.05 level. The results of the T-test are summarized in Table 42. It was found that the noneconomic benefits of graduates from cooperative and in-school methods of instruction in selected programs in vocational

Table 41. The noneconomic benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Cooperative Method			In-School Method		
N	Mean	SD	N	Mean	SD
96	49.9975	10.1845	61	50.1318	10.0369

Table 42. The summary of T-test of noneconomic benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

Cooperative Method	In-School Method	Variance	T	P>ITI
49.9975	50.1318	equal	-0.0810	0.9356

industrial school presented no significant difference at $\alpha = 0.05$ level. Results of testing failed to reject the null hypothesis 7 of this study.

Research hypothesis 8

It is hypothesized that: (1) the economic benefits, (2) noneconomic benefits of graduates from selected programs in vocational education cannot be predicted by these factors: (1) type of program, (2) graduate's ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's educational level, (7) employment location, (8) the status of employer, (9) on-the-job training experiences, and (10) the marital status of the graduates.

This research hypothesis was further divided into three sub-hypotheses as shown below:

Research hypothesis 8A: It is hypothesized that the private net benefits of graduates from selected programs in vocational education cannot be predicted by these factors: (1) type of programs, (2) graduate's ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's educational level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

Research hypothesis 8B: It is hypothesized that the social net benefits of graduates from selected programs in vocational education cannot be predicted by these factors: (1) type of programs, (2) graduate's ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's educational level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

Research hypothesis 8C: It is hypothesized that the noneconomic benefits of graduates from selected programs in vocational education cannot be predicted by these factors: (1) type of programs, (2) graduate's ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's educational level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

A stepwise multiple regression procedure was employed to test these null hypotheses. The social net benefits, the private net benefits, and

the noneconomic benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools were the dependent variables of these hypotheses. These factors, (1) type of programs, (2) graduate's ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's educational level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates were the independent variables of these hypotheses. The social net benefits and private net benefits were the same values used in testing hypothesis three before being adjusted by Denison alpha coefficient. The noneconomic benefits were the values used in testing hypothesis seven. The results of computer printout on testing hypothesis 8A were summarized in Table 43. (The codes were identified on page 62.)

Table 43. The summary of stepwise multiple regression of private net benefits of graduates from selected programs in vocational industrial high schools

Independent variables	Step 1	Step 2
X_1 (type of program)	-57354.31598	-59341.61195
X_9 (marital status)		-13120.18627
Intercept (constant)	146476.24740	151259.64864
Multiple R	0.67501	0.69021
R Square	0.45563	0.47639

It was found that when X_1 (type of program) was entered into the model, the regression coefficient was -57354.31598, and the intercept of the model was 146476.24740. The multiple R = 0.67501 and R^2 = 0.45563. In other words, 45.563% of variance accounts for X_1. When the second variable X_9 (marital status of graduates) was entered into the model, the regression coefficient for X_1 was -59341.612, and the regression coefficient for X_9 was -13120.1863; and the intercept for the model was 151259.64864. Multiple R = 0.69021, and R^2 = 0.47639. In other words, 47.639% of variances account for X_1 and X_9. After X_1 and X_9 were entered into the model, it was found that no other variables met the $\alpha = 0.05$ significant level for entry into the model. Therefore, the null hypothesis 8A was rejected at $\alpha = 0.05$ level. It was concluded that it is possible to predict the private net benefits of vocational graduates based upon the type of program from which they graduated, and on the marital status of vocational graduates, but not on other factors after the type of program and the marital status had been considered.

In order to test research hypothesis 8B, the social net benefits of vocational graduates and the independent variables of this study were input into a computer to run a stepwise multiple regression program. The results of computer printout were summarized in Table 44. (The codes were identified on page 62.)

It was found that when X_1 (type of program) was entered into the model, the regression coefficient was -62381.87012, and the intercept of the model was 159449.52279. The multiple R = 0.67518 and R^2 = 0.45587. In other words, 45.587% of variance accounts for X_1. When the second

Table 44. The summary of stepwise multiple regression of social net benefits of graduates from selected programs in vocational industrial high schools

Independent variables	Step 1	Step 2
X_1 (type of program)	-62381.87012	-64540.8267
X_9 (marital status)		-14253.49459
Intercept (constant)	159446.52279	164643.10936
Multiple R	0.67518	0.69035
R Square	0.45587	0.47659

variable X_9 (marital status of graduates) was entered into the model, the regression coefficient for X_1 was -64540.8267 and the regression coefficient for X_9 was -14253.49459. The intercept was 16463.10936. Multiple R = 0.69035, and R^2 = 0.47659. In other words, 47.659% of variances account for X_1 and X_9. After X_1 and X_9 were entered into the model, it was found that no other variables met the α = 0.05 significant level for entry into the model. Therefore, the null hypothesis 8A was rejected at α = 0.05 level. It was concluded that it was possible to predict the social net benefits of vocational graduates based upon the type of program from which they graduated, and on the marital status of vocational graduates, but not on other factors after the type of program and the marital status had been considered.

In order to test research hypothesis 8C, the noneconomic benefits score of vocational graduates and the independent variables of this study

were input into a computer to run a multiple regression program. The results of computer output were summarized in Table 45. (The codes were identified on page 63.)

Table 45. The summary of stepwise multiple regression of noneconomic benefits of graduates from selected programs in vocational industrial high schools

Independent variables	Step 1	Step 2
X_{12} (on-the-job training experience)	0.48359	0.47710
X_2 (machine shop)		-3.54973
Intercept (constant)	48.216972279	50.36689
Multiple R	0.24135	0.29687
R Square	0.05825	0.08813

It was found that when X_{12} (on-the-job training experience of graduates) was entered into the regression model, the regression coefficient was 0.48359, the intercept of the model was 48.21697; the multiple R = 0.24135 and R^2 = 0.05825. In other words, only 5.825% of variances of noneconomic benefits accounted for on-the-job training experience of graduates. When the second variable X_2 (the occupation for which trained was machine shop) was entered into the model, the regression coefficient for X_{12} was 0.47710, and the regression coefficient for X_2 was -3.54973. Multiple R = 0.29687, and the determination coefficient R^2 = 0.08813. In other words, only 8.813% of noneconomic benefits of vocational graduates

account for X_{12} and X_2. After X_{12} and X_2 were entered into the model, it was found that no other variables met the $\alpha = 0.05$ significant level for entry into the model. Therefore, the null hypothesis 8C was rejected at $\alpha = 0.05$ level. It was concluded that it was possible to predict the noneconomic benefits of vocational graduates based upon the on-the-job training experience of the graduates, and upon the occupation (machine shop) for which trained, but not on other factors after the on-the-job experience and the occupation for which trained has been considered. However, the predictability determination coefficient R^2 was considerably low, only 8.813% of the variance accounted for these two factors.

Research hypothesis 9

There is no significant linear relationship between benefits (economic and noneconomic) of graduates from selected programs in vocational education and the following factors: (1) type of program, (2) graduates ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's educational level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

In order to test research hypothesis 9, a canonical correlation statistical procedure was performed on a computer by using the SAS computer package. The dependent canonical variables included the economic benefits and noneconomic benefits of graduates from vocational industrial high schools sampled in this study. The independent canonical variables were the type of program, graduate's ability, school status, occupation

for which trained, father's occupation, father's educational level, employment location, the status of employer, on-the-job training experience, and the marital status of graduates. The economic benefits of graduates from vocational industrial high schools were further divided into categories: private net benefits and social net benefits, therefore, the research hypothesis 9 was further divided into two subhypotheses:

Research hypothesis 9A: There is no significant linear relationship between the private net benefits and the noneconomic benefits of graduates from selected programs in vocational education and the following factors: (1) type of program, (2) graduates ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's educational level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

Research hypothesis 9B: There is no significant linear relationship between the social net benefits and the noneconomic benefits of graduates from selected programs in vocational education and the following factors: (1) type of program, (2) graduates ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's educational level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

In order to test research hypothesis 9A, the private net benefits and the data for the ten independent variables were input into a computer. The results of this computation resulted in two significant correlations between the groups of variables. These two canonical correlations were significant at $\alpha = 0.05$ level. A summary of those results are given in Table 46. (The codes were identified on page 64.)

Upon examination of the standardized canonical coefficient of these variables, it was found that the private net economic benefits (PDVP) are more important to the canonical variate 1 (V_1) while the noneconomic benefits are more important to the canonical variate 2 (V_2). In the independent variables, X_1 (type of program), X_4 (furniture making), X_6 (school status), X_9 (marital status), and X_{11} (employer status) contributed a heavier weight in V_1 (canonical variate 1), while X_{12} (weeks of on-the-job training experience, X_2 (machine shop), X_8 (father's educational level), X_7 (father's occupation), and X_1 (type of program) contributed a heavier weight in V_2 (canonical variate 2).

A further examination of the correlation between the dependent variables and their canonical variable found that the private net economic benefits (PDVP) highly correlated with function variate 1 (V_1) while the noneconomic benefits (NEC) highly correlated with function variate 2 (V_2) as shown below:

Table 46. Summary of standardized canonical coefficients for testing hypothesis 9A (N = 157)

Variable	Step 1	Step 2
Independent variables		
Type of program (X_1)	-0.9065	-0.3587
Machine shop (X_2)	0.1147	-0.6399
Electricity (X_3)	0.1749	-0.2188
Furniture making (X_4)	0.2403	-0.2225
Graduate's ability (X_5)	0.0126	0.2627
School status (X_6)	0.2537	-0.2723
Father's occupation (X_7)	0.0014	-0.4369
Father's educational level (X_8)	0.1269	-0.5373
Marital status (X_9)	-0.1830	-0.0351
Employment location (X_{10})	-0.1423	-0.0319
Employer status (X_{11})	0.1966	-0.0261
Weeks of on-the-job training (X_{12})	-0.0883	0.6501
Dependent variables		
Private net benefits (Y_1)	1.0054	0.0915
Noneconomic benefits (Y_2)	-0.2289	0.9833

Canonical summary for all variables

Function	Canonical Correlation	Approx STD Error	Canonical R-Squared	F-statistics	DF	Prob>F
1	0.743884	0.035760	0.553363	7.3468	24/286	0.0000**
2	0.378398	0.068600	0.143185	2.1877	11/144	0.0181**

	V_1	V_2
NEC	-0.0907	0.9959
PDVP	0.9740	0.2267

An examination of correlations between the independent variables and their canonical variables, it was found X_1 (type of program), X_{10} (employment location), and X_6 (school status) are correlated to a greater extent with function variates (V_1), while X_{12} (on-the-job training experience), and X_2 (machine shop was trained) one correlated to a greater extent with function variate 2 (V_2).

In summary, two canonical correlations were obtained, each of which was significant at $\alpha = 0.05$ level. It was concluded that there exists significant linear combination relationship between the private net benefits and noneconomic benefits with the independent variables. The null hypothesis 9A was rejected at $\alpha = 0.05$ level.

In order to test research hypothesis 9B, the social net benefits and the ten independent variables data were input into a computer. The analysis of this computation resulted in two significant canonical correlations between the groups of variables. A summary of those results is given in Table 47.

Upon examination of the standardized canonical coefficients of these variables, it was found that the social net economic benefits (PDVP) are

Table 47. Summary of standardized canonical coefficients for testing hypothesis 9B (N = 157)

Variable	Step 1	Step 2
Independent variables		
Type of program (X_1)	-0.9065	-0.3588
Machine shop (X_2)	0.1147	-0.6399
Electricity (X_3)	0.1749	-0.2188
Furniture making (X_4)	0.2403	-0.2225
Graduate's ability (X_5)	0.0126	0.2627
School status (X_6)	0.2538	-0.2723
Father's occupation (X_7)	0.0014	-0.4369
Father's educational level (X_8)	0.1269	-0.5373
Marital status (X_9)	-0.1828	-0.0350
Employment location (X_{10})	-0.1423	-0.0319
Employer status (X_{11})	0.1965	-0.0261
Weeks of on-the-job training (X_{12})	-0.0882	0.6501
Dependent variables		
Private net benefits (Y_1)	1.0054	0.0915
Noneconomic benefits (Y_2)	-0.2289	0.9833

Canonical summary for all variables

Function	Canonical Correlation	Approx STD Error	Canonical R-Squared	F-statistics	DF	Prob>F
1	0.744031	0.035742	0.55358	7.3515	24/286	0.0000**
2	0.378396	0.068600	0.14318	2.1876	11/144	0.0181**

more influential to the canonical variate 1 (V_1) while the noneconomic benefits are more influential to the canonical variate 2 (V_2). The results of analysis are very similar with the analysis results found in testing hypothesis 9A.

In summary, two canonical functions were obtained in testing hypothesis 9B, each of which was significant at $\alpha = 0.05$ level. It was concluded that there exists significant linear combination relationship between the social net benefits and noneconomic benefits with the included independent variables. The null hypothesis 9B was rejected at $\alpha = 0.05$ level.

In addition to hypothesis testing, items 8, 9, and 10 related to the Cost-Benefit Survey Form of this study dealt with present employment status of the graduates. The results of analyzing the data of these items are listed in Table 48.

Table 48. The present employment status of the graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools

	Full-time employed	Military service	Business owner	Unemployed	In-school	Total
Cooperative method	82	1	4	1	9[a]	96
In-school method	52	2	3	3	3[b]	61

[a]One graduate reported that he attended university evening classes as a part-time student.

[b]Graduates attend a two-year college as a part-time student.

CHAPTER V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The first four chapters of this research study dealt with the introduction and background, review of the literature, methodology, analysis of data and findings of this study. The function and purpose of this chapter is to summarize the preceding chapters, draw conclusions based upon the findings, and present some recommendations.

Summary and Conclusions

This section provides a summary and the conclusions of the study based upon the findings of the preceding chapters. The nine research hypotheses are restated, followed by a brief conclusion of the findings.

Restatement of the problem

The problem of this study was to investigate and to compare the economic costs and benefits as well as the noneconomic benefits of the selected programs (machine shop, electricity, furniture making, and printing) in cooperative vocational industrial education instruction and in-school vocational industrial educational instruction at the secondary school level in Taiwan, R.O.C.

Restatement of the purpose

The purpose of this study was to conduct a cost-benefit analysis of the selected cooperative and in-school instructional methods of vocational industrial education at the secondary school level in Taiwan, the Republic of China and to compile comprehensive information of program

efficiency to the public, educators, and educational administrators for evaluating and for planning the existing programs.

Research hypothesis 1

There is no significant difference between the costs (private and social cost) from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Conclusion 1

It was found that the costs (private and social costs) of cooperative and in-school instructional methods of selected programs in vocational industrial schools in Taiwan are significantly different at α = 0.05 level. When a 0% discount rate was used, the private costs of cooperative method were NT$71,701 while the in-school method costs were NT$151,675; the social costs of cooperative method were NT$134,877 while the in-school method costs were NT$149,201. When a 5% discount rate was used, the private costs present discount value were NT$67,523 and NT$144,035, respectively, while the social costs present discount value were NT$127,919 and NT$141,471, respectively. When a 10% discount rate was used, the private costs present discount value were NT$64,376 and NT$137,310, respectively, while the social costs present discount value were NT$121,797 and NT$134,672, respectively. It was concluded, based upon the above findings that the in-school instructional method had significantly higher costs (private and social) than the cooperative instructional method did. The null hypothesis was rejected at α = 0.05 level.

Research hypothesis 2

There is no significant difference between the earning of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools during the first five years of work.

Conclusion 2

It was found that the first five years' earnings of graduates from cooperative and in-school methods were not significantly different at α = 0.05 level. When a 0% discount rate was used, the first five years' earnings of graduates from cooperative method were NT$673,371, while the in-school graduates were NT$647,725. When a 5% discount rate was used, then the present discount value of the first five years' earnings were NT$473,473 and NT$455,974, respectively. When a 10% discount rate was used, the present discount value of the first five years' earnings of graduates were NT$339,885 and NT$327,704, respectively. It was concluded, therefore, that there was no significant difference between the first five year's earnings of graduates from cooperative or in-school instructional methods from vocational industrial high schools in Taiwan. Results failed to reject the null hypothesis at α = 0.05 level.

Research hypothesis 3

There is no significant difference between the net present value of benefits (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Conclusion 3

It was found that there was a significant difference between the net present value of benefits (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools at $\alpha = 0.05$ level. When a 0% discount rate was used, the private net present value of benefits of cooperative method were NT$96,643.73 thousand, while the in-school method were NT$58,787.797 thousand; the social net present value of benefits of cooperative method were NT$105,182.134 thousand, while the in-school method were NT$64,029.524 thousand. When a 5% discount rate was used, the private net present value of benefits were NT$17,388.898 thousand and NT$11,160.31 thousand, respectively, while the social net present value of benefits were NT$18,914.832 thousand and NT$12,140.03 thousand, respectively. When a 10% discount rate was used, the private net present value of benefits were NT$3,937.34 thousand and NT$2,683.07 thousand, respectively, while the social net present value of benefits were NT$4,279.16 thousand and NT$2,911.448 thousand, respectively. It was concluded, therefore, that the graduates from the cooperative method of instruction had significantly higher private and social net present value of benefits than did the graduates of in-school method of instruction. The null hypothesis was rejected at $\alpha = 0.05$ level.

Research hypothesis 4

There is no significant difference between the rate-of-return (private and social) of graduates from cooperative and in-school

instructional methods of selected programs in vocational industrial high schools.

Conclusion 4

It was found that the rate-of-return (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools in Taiwan are significantly different at $\alpha = 0.05$ level. The private rate-of-return of cooperative instructional method was 53.91% while the in-school method of instruction was 38.10%. The social rate-of-return for cooperative instructional methods was 41.96% while for the in-school method of instruction it was 38.46%. It was concluded, therefore, that the cooperative instructional methods had a significantly higher private and social rate-of-return than did the in-school method of instruction. The null hypothesis was rejected at $\alpha = 0.05$ level.

Research hypothesis 5

There is no significant difference between the benefit-cost ratio (private and social) of graduates from cooperative and in-school industrial methods of selected programs in vocational industrial high schools.

Conclusion 5

It was found that the benefit-cost ratio (private and social) between the graduates from cooperative and in-school method of instruction in selected program of vocational industrial schools were

significantly different at $\alpha = 0.05$ level. When a 0% discount rate was used, the private benefit-cost ratio for cooperative method was 2609.09 while for the in-school method it was 735.13; the social benefit-cost ratio for the cooperative method was 1378.16 while for the in-school method it was 746.12. When a 5% discount rate was used, the private benefit-cost ratios were 485.63 and 143.09, respectively, while social benefit-cost ratios were 257.12 and 145.45, respectively. When a 10% discount rate was used, the private benefit-cost ratios were 114.39 and 35.97, respectively, while the social benefit-cost ratios were 60.64 and 30.62, respectively. It was concluded, therefore, that the graduates from cooperative method of instruction of selected programs in vocational industrial high schools had significantly higher private and social benefit-cost ratios than did the graduates from the in-school method of instruction. The null hypothesis was rejected at $\alpha = 0.05$ level.

Research hypothesis 6

There is no significant difference between the payback period (private and social) of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Conclusion 6

It was found that the payback period (private and social) between graduates from cooperative and in-school methods of instruction in selected programs of vocational industrial high schools were significantly different at $\alpha = 0.05$ level. When a 0% discount rate was used, the private payback period of cooperative method was 8.94 months while the in-

school method was 18.10 months; the social payback period for cooperative method was 16.09 months while for the in-school method it was 17.85 months. When a 5% discount rate was used, the private payback periods were 10.75 months and 22.02 months, respectively, while the social payback periods were 19.36 months and 21.69 months, respectively. When a 10% discount rate was used, the private payback periods were 12.86 months and 26.93 months, respectively, while the social payback periods were 23.40 months and 26.49 months, respectively. It was concluded, therefore, that the graduates from the cooperative method of instruction of selected programs in vocational industrial high schools had a significantly shorter private and social payback period than did the graduates from the in-school method of instruction. The null hypothesis was rejected at $\alpha = 0.05$ level.

Research hypothesis 7

There is no significant difference between the noneconomic benefits of graduates of cooperative and in-school instructional methods of selected programs in vocational industrial high schools.

Conclusion 7

It was found that the noneconomic benefits of graduates from cooperative and in-school methods of instruction in selected programs in vocational industrial schools presented no significant difference at $\alpha = 0.05$ level. Results of testing failed to reject the null hypothesis at $\alpha = 0.05$ level.

Research hypothesis 8

It is hypothesized that (1) the economic benefits, and (2) the non-economic benefits of graduates of selected programs in vocational education cannot be predicted by these factors: (1) type of program, (2) student ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's education level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

Conclusion 8

From the results of testing the economic benefits aspect of this hypothesis, it was found that it is possible to predict the economic benefits of graduates from cooperative and in-school methods of instruction in vocational industrial high schools based upon the type of program from which they graduated (X_1), and upon the marital status of graduates (X_9) but not on other factors after the type of program and the marital status had been considered at $\alpha = 0.05$ level.

The model for private economic benefits is:

$$Y_1 = -59341.612\ X_1 - 13120.186\ X_9 + 151259.65\ (R^2 = 0.4764)$$

The model for social economic benefits is:

$$Y_2 = -64540.83\ X_1 - 14253.495\ X_9 + 16463.11\ (R^2 = 0.4766)$$

Therefore, this subhypothesis was rejected at $\alpha = 0.05$ level. From the results of testing the noneconomic benefits aspect of this hypothesis, it was found that it is possible to predict the noneconomic benefits of graduates based upon the on-the-job training experience of graduates

(X_{12}), and upon the occupation (machine shop) for which trained (X_2), but not upon other factors after the on-the-job training experience and the occupation (machine shop) for which trained has been considered at α = 0.05 level.

The model for noneconomic benefits is:

$$Y_3 = 0.4771\ X_{12} - 3.54973\ X_2 + 50.37\ (R^2 = 0.08813)$$

Therefore, this subhypothesis was rejected at α = 0.05 level. In summary of testing hypothesis 8, it was found that the economic and noneconomic benefits of graduates from cooperative and in-school instructional methods of selected programs in vocational industrial high schools can be predicted based upon the identified factors. The null hypothesis was rejected at α = 0.05 level.

Research hypothesis 9

There is no significant linear relationship between benefits (economic and noneconomic) of graduates of selected programs in vocational education and the following factors: (1) type of program, (2) student's ability, (3) school status, (4) occupation for which trained, (5) father's occupation, (6) father's education level, (7) employment location, (8) the status of employer, (9) on-the-job training experience, and (10) the marital status of the graduates.

Conclusion 9

The results of the canonical correlation analysis resulted in two significant canonical correlations between the groups of variables. These two canonical correlations were significant at α = 0.05 level.

Upon an examination of the standardized canonical coefficient of these variables, it was found that the economic benefits were more important to the canonical variate 1 (V_1) while the noneconomic benefits were more important to the canonical variate 2 (V_2). For the independent variables, type of program (X_1), furniture making (X_4), school status (X_6), marital status (X_9), and employer status (X_{11}) each contributed a heavier weight to canonical variate 1 (V_1), while weeks of on-the-job training experience (X_{12}), machine shop (X_2), father's educational level (X_8), and type of program (X_1) contributed a heavier weight to canonical variate 2 (V_2). It was concluded that there exists significant linear combination relationship between the economic and noneconomic benefits with the ten independent variables. The null hypothesis was rejected at $\alpha = 0.05$ level.

Based upon above evidence, it is concluded that the cooperative instructional method is more cost-benefit effective than the in-school instructional method in selected programs in vocational industrial high schools in Taiwan, the Republic of China, at $\alpha = 0.05$ level.

Researcher's Overview

This section provides a personal viewpoint of the researcher in addition to the findings and conclusions based on the statistical analysis.

1. Measurement difficulties in noneconomic benefits of vocational education have limited the majority of previous researchers who only considered the economic benefits in their research. To ignore noneconomic benefits in a cost-benefit research study tends to underestimate the

total benefits of vocational education. Therefore, the researcher tried to include and to quantify the educational effectiveness, job opportunities, job satisfaction, job permanence, social involvement, voting participation, leisure time usage, work attitude, sense of well-being, attitude related to change, and the social adjustment of the graduate in this study.

2. In the process of analyzing the public expenditure of private schools in Taiwan, it was found that the public investment in those schools could not compare with the public investment in public schools. Such an inequality is unfair to the students enrolled in those private institutions. Therefore, increased public investment and funding to private educational institutions will be a new challenge and benefit to future vocational education students in Taiwan.

3. Upon an examination of the costs and benefits relationship of vocational education, it was found that private investment sector of public schools was too low. Since the private costs in public schools was relatively low, therefore, the public expenditures were relatively higher than expected. How to readjust the school fees, tuition and reallocate the resources in public school sector will be another challenge to future vocational education leaders in Taiwan.

The cost effectiveness of the cooperative method of instruction which garners added human and material resources of the training station provided by the employer augers exceedingly well to confirming this method universally superior to in-school method of instruction for vocational education to build stronger linkages between industry and education.

Recommendations

As a result of this study, the following recommendations were made:

1. It is recommended that a similar study be undertaken by using the total population of the graduates of cooperative and in-shcool instructional methods of vocational industrial high schools in Taiwan.

2. It is recommended that another researcher conduct a study to validate the Denison alpha coefficient in the field of vocational industrial education in Taiwan.

3. It is recommended that other studies be conducted employing a long-term longitudinal study to validate some variables in cost-benefits analysis, such as the earnings prediction model of vocational graduates, the difference in earnings increase rate between the graduates of vocational education and junior high graduates, and the earnings profile of graduates at different life-time stages in Taiwan.

4. It is recommended that future researchers may want to examine a more inclusive list of noneconomic benefits than those included in current study.

5. It is recommended that future researchers may want to investigate and compare the costs and benefits of on-the-job training experience of the coopreative instruction method and its impact on the productivity of the graduates.

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ACKNOWLEDGMENTS

Grateful appreciation is expressed to my major Professor, Dr. William D. Wolansky, for his encouragement and guidance in preparing this dissertation.

Recognition is given to the many people who had contributed to the successful completion of this study, with a special acknowledgment to the members of my graduate committee: Dr. William G. Miller, Dr. Trevor G. Howe, Dr. Robert J. Gelina, and Dr. Donald H. Schuster, and to my typist, Ms. Susan Danks.

A special appreciation is extended to my parents for their encouragement and love, and to my wife and my children, for their patience and understanding during the course of my graduate study at Iowa State University.

APPENDIX A. COST-BENEFIT SURVEY FORM

COST-BENEFIT SURVEY FORM

I. Basic Data

1. What type of program did you graduate from?
   _____ Cooperative program
   _____ In-school program

2. What type of occupation did you study in vocational industrial high school?
   _____ Machine shop
   _____ Electricity
   _____ Furniture making
   _____ Printing

3. Please rate your overall graduation rank in your class.
   _____ 81% or above
   _____ 61% to 80%
   _____ 41% to 60%
   _____ 21% to 40%
   _____ 20% or below

4. What type of school organization did you graduate from?
   _____ Public
   _____ Private

5. What is (was) your father's occupation? _____

6. What is (was) the educational background of your father?

0 1 2 3 4 5 6	7 8 9	10 11 12	13 14 15 16	17 18 19 20
Primary school	Junior High	Senior High	College	Graduate Study

7. What is your marital status:
   _____ Married _____ Single _____ Separated, widowed or divorced

8. What is your present employment status?
   _____ Employed full time
   _____ Employed part time
   _____ Military service
   _____ Unemployed
   _____ Business owner

9. If you are unemployed, please explain:
   _____ Homemaker
   _____ In school
   _____ Looking for a job
   _____ Other (specify) _____

10. If you are in school, the level of the school is:
_____ Two-year college
_____ Four-year college or university

11. Where is your employment location?
_____ Rural
_____ Urban

12. Your current employment is in which type of organization?
_____ Public
_____ Private

13. How many weeks have you received on-the-job training since graduation?
_____ weeks (total)

II. Cost Data

14. While in school, did you receive any loans to defray the cost of your education?
_____ Yes If yes, total amount NT$_____
_____ No

15. While in school, did you receive any scholarships or grants?
_____ Yes If yes, estimate the average annual income from
_____ No these sources: NT$_____

16. As a student, how much did you earn per year from part-time or full-time jobs?

1975 NT$_____
1976 NT$_____
1977 NT$_____

17. On the average, how much did you spend per year on tuition, books, and school fees?

Tuition_____ Books_____ Fees_____ Total_____

18. Where did you reside while attending school?
_____ At home
_____ Rented apartment
_____ Other (specify)_____

19. Please list the average cost of the above residence.

NT$_____ per month.

20. On the average, how much did you spend per month on transportation while attending school?

NT$_____

III. Benefits Data

21. My job is highly related to my training in school.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

22. The school placement office was very helpful in finding my first job.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

23. I would take the same program over again if I had the choice.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

24. What kind of skill certification did you obtain?

A	B	C	not acquired

25. Number of jobs you held since graduation (including your present job)?
Number full-time _____
Number part-time _____

26. Number of promotions you have received since graduation from high school?

_____

27. How long did it take to find a job after graduating from school?

_____ weeks

28. How many weeks have you been unemployed since graduation, if at all.

_____ weeks (total)

29. How satisfied are you with your present job?
_____ Very satisfied
_____ Fairly satisfied
_____ Neutral
_____ Fairly dissatisfied
_____ Very dissatisfied

30. What were the average monthly salaries and fringe benefits you received from your job after graduation?

NT$_____ per month in 1980 NT$_____ per month in 1983

NT$_____ per month in 1981 NT$_____ per month in 1984

NT$_____ per month in 1982

31. If employed, how many hours do you work during an average week?
_____ hours regular time
_____ hours overtime

32. I consider my present job to be a permanent occupation.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

33. Please check all social organizations, clubs etc. of which you are a member.

Number	Type of organization
_____	School related organization
_____	Sportsman clubs
_____	Church or religious organization
_____	Social clubs or activities
_____	Volunteer work
_____	Community service
_____	Union activity
_____	Others (specify)_____

34. How many times have you voted for county officer, mayor, and legislature?

_____

35. I will vote in the future.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

36. How many hours per week of your free time do you spend in the following activities?

_____ 1. Academic activities, such as study, taking adult education course
_____ 2. Social affairs, such as volunteer work, club activities, etc.
_____ 3. Creative or artistic efforts such as writing, painting, or playing an instrument.
_____ 4. Activities involving the consumption of alcohol
_____ 5. Doing hobbies like woodworking, leather, tooling, repairing, etc.
_____ 6. Physical exercise, such as sports, hunting, fishing, or walking
_____ 7. Watching TV, listening to the radio broadcasting, or enjoying a movie
_____ 8. Doing nothing
_____ 9. Other (specify)_____

37. I have enough leisure time

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

38. I find leisure activities boring.

Strongly agree	Agree	Neutral	Disagree	Strongly disagree

ATTITUDE

Directions: The following items are some attitude statements related to a job. There are no right or wrong answers. Please circle the response which best describes how you feel about the statement.

A = agree D = disagree

A D 1. I am slightly interested in my present job.

A D 2. Most work is dull and boring.

A D 3. A good indication of a person's work is how well he does his job.

A D 4. If all other things are equal, it is better to have a job with a lot of responsibility than one with little responsibility.

A D 5. Wasting time is as bad as wasting money.

A D 6. Hard work makes an individual a better person.

A D 7. Whenever possible, a person should relax and accept life as it is, rather than always striving for unreachable goals.

A D 8. I feel I have little influence over the things that happen to me.

A D 9. I feel like a failure.

A D 10. I feel that I have a great many enemies.

A D 11. There is a good future for me in my present job and environment.

A D 12. I feel my family has benefited from my job as we have a happier home life.

A D 13. I feel confident that I can do something about problems that may arise in the future.

A D 14. I like the people I work with.

A D 15. I am happier now than a year ago.

A D 16. I am not concerned about innovation in my job.

A D 17. I don't even know what innovation is.

A D 18. People who do things the easy way are the smart ones.

A D 19. I believe that there are other approaches to my job that might work better.

A D 20. When my co-workers find a new approach to solve a problem, I always try to follow their new methods as soon as possible.

A D 21. I would like to know what other companies are doing in my area.

A D 22. At this time, I have little interest in learning anything new.

A D 23. I have few opportunities to learn new techniques for my job.

A D 24. Becoming a success is mainly a matter of luck; hard work doesn't help very much.

A D 25. The wise person lives for today and lets tomorrow take care of itself.

A D 26. Most people can be trusted.

A D 27. It is hard to get ahead without breaking the rules now and then.

A D 28. Most people in charge enjoy their power and control.

A D 29. I enjoy doing little favors for people even if I don't know them very well.

A D 30. I get even with people who wrong me as soon as I can, so I can forget it.

APPENDIX B. QUESTIONNAIRE FOR JUDGE AND SCALE VALUES

FOR JUDGE

Scaling directions: Assume a subject agrees to each of the items below. Indicate how "good" his/her attitude toward work is by checking the appropriate category:

5 - Very good attitude
4 - Good attitude
3 - Neither good nor bad
2 - Poor attitude
1 - Very poor attitude

A. Work Attitude

5 4 3 2 1 (1) I am slightly interested in my present job.

5 4 3 2 1 (2) Most work is dull and boring.

5 4 3 2 1 (3) A good indication of a person's worth is how well he does on his job.

5 4 3 2 1 (4) If all other things are equal, it is better to have a job with a lot of responsibility than one with little responsibility.

5 4 3 2 1 (5) Wasting time is as bad as wasting money.

5 4 3 2 1 (6) Hard work makes an individual a better person.

5 4 3 2 1 (7) Whenever possible, a person should relax and accept life as it is, rather than always striving for unreachable goals.

B. Sense of Well Being

5 4 3 2 1 (1) I feel I have little influence over the things that happen to me.

5 4 3 2 1 (2) I feel like a failure.

5 4 3 2 1 (3) I feel that I have a great many enemies.

5 4 3 2 1 (4) There is a good future for me in my present job and environment.

5 4 3 2 1 (5) I feel my family has benefited from my job as we have a happier home life.

5 4 3 2 1 (6) I feel confident that I can do something about problems that may rise in the future.

5 4 3 2 1 (7) I like the people I work with.

5 4 3 2 1 (8) I am happier now than a year ago.

C. Attitude Related to Change

5 4 3 2 1 (1) I am not concerned about innovation in my job.

5 4 3 2 1 (2) I don't even know what innovation is.

5 4 3 2 1 (3) People who do things the easy way are the smart ones.

5 4 3 2 1 (4) I believe that there are other approaches to my job that might work better.

5 4 3 2 1 (5) When my co-workers find a new approach to solve a problem, I always try to follow their new methods as soon as possible.

5 4 3 2 1 (6) I would like to know what other companies are doing in my area.

5 4 3 2 1 (7) At this time, I have little interest in learning anything new.

5 4 3 2 1 (8) I have few opportunities to learn new techniques for my job.

D. Social Adjustment

5 4 3 2 1 (1) Becoming a success is mainly a matter of luck; hard work doesn't help very much.

5 4 3 2 1 (2) The wise person lives for today and lets tomorrow take care of itself.

5 4 3 2 1 (3) Most people can be trusted.

5 4 3 2 1 (4) It is hard to get ahead without breaking the rules now and then.

5 4 3 2 1 (5) Most people in charge enjoy their power and control.

5 4 3 2 1 (6) I enjoy doing little favors for people even if I don't know them very well.

5 4 3 2 1 (7) I get even with people who wrong me as soon as I can, so I can forget it.

Table 49. Scale value for attitude items

Item No.	Total Ratings	Scale Value	Discriminal Dispersion
1	60	.634	.702
2	60	.697	.771
3	60	2.357	.919
4	60	2.346	.843
5	60	2.514	1.090
6	60	2.466	.986
7	60	1.523	1.125
8	60	1.044	.793
9	60	.481	1.064
10	60	.362	1.198
11	60	2.139	.942
12	60	2.248	.995
13	60	2.384	.921
14	60	2.454	1.159
15	60	2.147	1.045
16	60	.426	1.002
17	60	.388	1.054
18	60	2.027	.957
19	60	2.376	.890
20	60	2.586	1.123
21	60	2.392	1.161
22	60	.428	1.049
23	60	.715	.718
24	60	.177	1.737
25	60	.887	.890
26	60	1.635	.912
27	60	.410	1.008
28	60	1.000	.892
29	60	2.403	.888
30	60	.131	.964

APPENDIX C. CORRELATION COEFFICIENTS

Table 50. Correlation coefficients

	PDVP	PDVS	X1	X2	X3	X4	X5	X6
PDVP	1.00000	1.00000	-0.67501	-0.05715	0.00267	0.11049	-0.14264	0.22018
PDVS	1.00000	1.00000	-0.67518	-0.05707	0.00265	0.11044	-0.14269	0.22038
X1	-0.67501	-0.67518	1.00000	-0.06725	0.09365	0.02570	0.21776	-0.28781
X2	-0.05715	-0.05707	-0.06725	1.00000	-0.66627	-0.38220	-0.14252	0.36228
X3	0.00267	0.00265	0.09365	-0.66627	1.00000	-0.17067	0.12876	-0.04590
X4	0.11049	0.11044	0.02570	-0.38220	-0.17067	1.00000	-0.01877	-0.28797
X5	-0.14264	-0.14269	0.21776	-0.14252	0.12876	-0.01877	1.00000	-0.13758
X6	0.22018	0.22038	-0.28781	0.36228	-0.04590	-0.28797	-0.13758	1.00000
X7	0.06976	0.06984	-0.18058	0.10191	-0.02491	-0.11909	-0.08133	0.21181
X8	-0.04693	-0.04700	0.16233	-0.19260	0.10950	0.10312	0.04220	-0.22285
X9	-0.03404	-0.03388	-0.16025	0.20480	-0.06598	-0.11062	-0.05523	0.27710
X10	-0.18442	-0.18448	0.13941	-0.08133	0.02782	-0.00925	0.14497	-0.18662
X11	0.00866	0.00854	0.13941	-0.16048	-0.03370	0.17225	-0.04573	-0.42019
X12	-0.11064	-0.11064	0.10882	-0.01874	-0.05561	0.00419	0.00974	-0.03020
NEC	0.13747	0.13744	0.00651	-0.17736	0.06768	0.03692	0.13141	-0.15447

Table 50. (continued)

	X7	X8	X9	X10	X11	X12	NEC
PDVP	0.06976	-0.04693	-0.03404	-0.18442	0.00866	-0.11064	0.13747
PDVS	0.06984	-0.04700	-0.03388	-0.18448	0.00854	-0.11064	0.13744
X1	-0.18058	0.16233	-0.16025	0.13941	0.13941	0.10882	0.00651
X2	0.10191	-0.19260	0.20480	-0.08133	-0.16048	-0.01874	-0.17736
X3	-0.02491	0.10950	-0.06598	0.02782	-0.03370	-0.05561	0.06768
X4	-0.11909	0.10312	-0.11062	-0.00925	0.17225	0.00419	0.03692
X5	-0.08133	0.04220	-0.05523	0.14497	-0.04573	0.00974	0.13141
X6	0.21181	-0.22285	0.2771	-0.18662	-0.42019	-0.03020	-0.15447
X7	1.00000	-0.58385	0.02689	-0.00797	-0.00797	0.04179	-0.06192
X8	-0.58385	1.00000	-0.09789	-0.03524	-0.05024	0.04852	-0.05525
X9	0.02689	-0.09789	1.00000	-0.11585	-0.28426	-0.02178	-0.04368
X10	-0.00797	-0.03524	-0.11585	1.00000	0.21237	0.09614	0.07043
X11	-0.00797	-0.05024	-0.28426	0.21237	1.00000	-0.07638	0.03078
X12	0.04179	0.04852	-0.02178	0.09614	-0.07638	1.00000	0.24135
NEC	-0.06192	-0.05525	-0.04368	0.07043	0.03078	0.24135	1.00000